DEC 20 1883

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXIX. No. 4. Whole No. 580. | NEW YORK, THURSDAY, AUGUST 16, 1883. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shilling—18 francs). All payments to be made in advance. Single copies, 15 cents.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will mail, post-paid, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

Eleventh Annual Meeting of the American Gas Light Association—Official Notice 73

EDITORIALS—

Day Consumption 73
Striking Oil 74
Giving Away Gas 74
The Management of Small Gas Works 75
How Ammonia is Lost in Gas Works 76
English Brick for Oregon 76
The Construction of High Power Burners for Heating; with Suggestions for Increasing the Day and Summer Consumption of Gas 77
*Improved Gas Burners 80
Value of Gas as an Illuminant for Lighthouses 80

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 81

Toronto (Can.) Furnishes a Victim—The Chicago Gas Light and Coke Company to Sell Gas at $1 per Thousand—Notes from Winchester, Va.—Gas Matters at Delphos, Ohio—After the Poles—Bridges to be Lighted by Electricity—The Brush Patents Given Precedence—Albany (N. Y.) Street Lighting—The Chautauqua Heat and Light Company—Personal—The System of Gas Lighted Buoys Growing in Favor—Philadelphia Gas Trust Receipts—A Proposed Murdoch Memorial—Gas Works at Mankato, Minn.—Protecting Iron from Rust—Good Work Done by a "Westinghouse" Engine—Machinery and Fittings for the Richmond (Va.) Gas Works—Price of Gas Reduced in Denver, Col.—Still Cheaper Gas for Wheeling, West Va.—And Still the List Grows—And Yet Another—This Time Not Fatal—Electricity on East River Ferryboats.

The Market for Gas Securities 83

CORRESPONDENCE—

Day Consumption 84
Don't Believe in Water Gas 84

[OFFICIAL NOTICE.]

Eleventh Annual Meeting of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
SECRETARY'S OFFICE, NEW YORK, Aug. 9, 1883.

The Eleventh Annual Meeting of the American Gas Light Association will be held in New York city on the 17th day of October, 1883, at 10 A.M., and continue for three days. Arrangements for headquarters, place of meeting, and general details are now under consideration by the Local Committee, and will be duly announced.

Members are earnestly requested to prepare papers to be read, or to present, in other form, such facts as may be of general benefit which the experiences of management may have given them.

The Association owes to itself the duty of rendering its meetings of interest and practical value, not to its members alone, but also to that growing circle of those outside of its membership who, interested in the same industry, naturally look to this Association for instruction. It is therefore of the utmost importance that evidence of our active participation in, and knowledge of, the changing conditions of our business should mark the proceedings of the Association, if its influence upon the gas industry of the country is to be of permanent value. To this end all must share in the labor incident to the work, and feel an individual interest and responsibility.

The Secretary requests members to notify him, at as early a date as possible, of the topics they may select for papers. All requests and suggestions should be addressed to the Secretary, at 94 Dearborn street, Chicago, to receive prompt attention. WM. HENRY WHITE, Secretary.

DAY CONSUMPTION OF GAS.

We publish in this number of the JOURNAL a communication from an esteemed correspondent, calling attention to the importance of having a record kept at all gas works of the quantity of gas consumed in the daytime, with the object of ascertaining the quantity used for mechanical and domestic purposes, or for purposes other than illumination. Our correspondent also alludes to the advantage of thus increasing in every possible way the sale of gas during the day for the purposes mentioned above, since the larger the sales are increased the cheaper the gas can be furnished.

The latter fact is well known, and the endeavor to increase the sale of gas for day use has received very careful attention on the part of a large number of the managers of gas works. Our correspondent is in error in the assertion that these matters have received very little consideration from American managers, as we know to the contrary of this; and, also, that in a number of instances every effort has been made to bring into use, either for mechanical or other purposes, the gas manufactured, knowing that by this means the sale of gas can be largely increased for day use, and the business much improved by such action.

A fact well known and appreciated by gas engineers is that an increased supply of gas for day use can be furnished without any great additional cost of plant for manufacturing. The engineers with whom we are brought most intimately in connection have a record of gas sent out in the different portions of the 24 hours of the day, dividing the day into 2, 3, or 4 hour peri-

ods, and keeping an account of the gas sent out in each of these divisions of the 24 hours.

A good way to get the consumption of gas in the 24 hours is, for one month in each of the seasons, to make hourly observations of the meter and holders, the temperature, and the state of the weather, which will give a fair average of the gas sent out in each hour of the 24. After obtaining these data, the day can be divided into 6, 8, or 12 parts, as may be desired, making the observations every 2, 3, or 4 hours of the 24. By continuing this system, it will add greatly to the information of those having gas works under their supervision relative to the hours in which the greatest quantity of gas is consumed, and, at the same time, keep them better posted in a very essential part of the business in which they are engaged.

The distribution of gas for use in the daytime would not require the heavy pressure in use at night, unless the day consumption was increased in equal quantity to that used in the night hours; and should this result, the extra pressure for the day could be readily afforded, as the loss under the circumstances would not exceed that of the night hours, and the loss would certainly be less on the total quantity of gas sent out.

When there is required, say, a maximum pressure of 3 inches at the works as night pressure, ordinarily a pressure of one inch during the day will amply supply all the gas required for mechanical and heating purposes; while, at the same time, it would not entail upon any company any great loss in unaccounted-for gas.

The Professor makes a very sensible suggestion when he says if gas cannot be sent out in the daytime, on account of the increased loss by leakage, "stop your leaks." This we would advise everyone to do, and do it at once. When the street mains are in a bad condition, either from inferior pipe or castings, or improper jointing or laying, the loss by leakage goes steadily on, and will very materially increase the cost of the gas delivered, and operate to the great detriment of any company so situated. We have known of cases where, from the imperfect and poor quality of the mains in use, and the manner in which they were put in the ground, companies were losing from 30 to 50 per cent. of the gas manufactured, and this with the gas shut off in the daytime.

By a thorough overhauling and a replacement of mains, this loss has been materially reduced, and these same companies have now, with a large increase in the length of the mains in use, reduced the unaccounted-for gas so that it will not exceed 6 or 8 per cent. of the total quantity manufactured.

While on this subject of street mains, it may very properly be said that the system, or rather want of system, in which a great part of this kind of work is done, adds very materially to the losses in unaccounted-for gas. Careful and thorough work would obviate this.

There is also a disposition on the part of many who have this matter in charge to use pipes of small diameter, simply because the first cost of the same is less, not considering that, by the use of such the loss of gas is increased, on account of the greater pressure required to deliver the gas. The cost of labor for laying 3, 4, or 6-inch pipe will vary very little—the difference of cost being in the pipe and the lead used for joints, while the area or capacity for delivery of the above sizes is (less fractions), 7, 12½, and 28 square inches. From this will be seen the advantage of having large pipe for an easy delivery of gas, with a lower initial pressure at the works.

In mapping out for street mains in any city or town, supply mains can be so placed that they will give, at all points, the quantity of gas required; and this can be done with a low pressure at the works, bearing in mind that it is volume and not pressure that is required for the proper delivery and economical burning of gas. With the supply mains properly placed, an increased quantity of gas can readily be delivered in any section where there is necessity for so doing, owing to an increased consumption, by extending the large main to the place where such increase is demanded.

Striking Oil.

Mr. E. V. Smalley, in an interesting contribution to the *Century* magazine, says that the known and defined petroleum region in the States is confined, it appears, to a country about 150 miles long, with a varying breadth of from 1 to 20 miles; and the yield from this large area, which in 1881 amounted to 26,950,813 barrels, reached 31,398,700 barrels in 1882. It must not be supposed, writes the author, that the oil-bearing sandstone stratum underlies the whole region. It is found only in spots, patches, and belts, and there are no surface indications to show where it can be successfully sought. The entire productive territory covers an area of only 189,000 acres. The outlines of a producing district are established only by experiment, and new districts are discovered by wasting sums of money on "dry holes." On Oil Creek the first wells struck the oil-bearing sandstone at the depth of 600 feet. In the Butler and Clarion fields the wells are about 1,400 feet deep, in the Bradford field from 1,100 to 2,000 feet, in the Allegheny field from 900 to 1,400 feet, and in Cherry Grove 1,000 feet. The variation of depth in the same field is caused by the hills. The oil-sand stratum varies in thickness from 5 to 30 feet. It is thickest in the Bradford field. There it is dark colored and fine grained; elsewhere it is of lighter color and more porous.

Boring for petroleum is less than a quarter of a century old. It dates from August 30, 1859, when Col. E. L. Drake struck oil on the Drake farm, on Oil Creek. In 1859 Col. Drake's well produced about 2,000 barrels of oil; in 1860 new wells brought the total yield up to 500,000 barrels; in 1861 it was 2,113,609 barrels; and in 1862 it was 3,056,690 barrels. The production of crude petroleum fell off in 1863, 1864, and 1865, but the discovery of the new Tidioute district, and of the famous flowing wells of Pithole brought it up in 1866 to 3,887,700 barrels. The Butler and Clarion counties fields, and fresh discoveries in Venango county, ran the production up steadily during the following years, until it reached 10,809,852 barrels in 1874. Then came two years of decline, the elder wells giving out and the newer ones yielding less and less. In 1875 the Bradford field was discovered. Its development proceeded so rapidly, and it proved to be of so great extent, that in 1880 its yield was double that of all other fields in 1874, and about six times as great as all others at that time. Of the 26,000,000 barrels produced in 1880, over 22,000,000 came from the Bradford district.

The Allegheny district was opened in 1881, and now ranks next to Bradford; and the phenomenal Cherry Grove field in Warren county had its rise and fall in 1882. A number of small districts, or pools, in Warren, M'Kean, and Venango counties, were opened between 1875 and 1881. For sudden and enormous effect upon values, the Cherry Grove excitement of last summer was without parallel in the history of the petroleum trade. It surpassed the famous Pithole furore of 1865. On May 17 "646" struck oil, and 4,000 barrels were run the first day. In a few days the value of oil suffered a shrinkage of $30,000,000. Crude petroleum tumbled from 85 cents to 49 cents. Within a brief period the hemlock woods of Cherry Grove township were alive with men and teams, hauling boilers, engines, drilling tools, lumber for derricks and shanties, kegs of beer, boxes and barrels of provisions, furniture—all the equipment, in short, of a new settlement. Before the end of June two bustling towns had sprung up—one called Garfield, in honor of the martyr President, and one Farnsworth, for the owner of the farm where the wonderful well was sunk. Land that had lately been sold at $4 an acre to pay the taxes changed hands in five acre tracts at from $500 to $1,000 an acre. Hotels, stores, machine shops, saloons, and a theatre sprang up as if by enchantment. In August the Cherry Grove field produced 40,000 barrels a day; but from that maximum it steadily declined, and when the writer visited it in October the daily yield from all the wells was less than the yield of 646 during the first 24 hours after it commenced flowing.

It costs about 80 cents a foot to sink a well by contract. The cost of a finished well, with apparatus complete, varies from $3,000 to $4,000, according to the depth at which the oil stratum is found and the expense of getting the engine and boiler on the ground. If a well proves a dry hole, or fails to yield enough oil to pay for pumping, and the owner removes the machinery to other ground for a fresh experiment, he is out of pocket from $1,000 to $1,500.

In the whole Pennsylvania and New York field the number of producing wells is at this time not far from 20,000, of which about 13,000 are in the Bradford district. The number of dry holes and exhausted wells no man has endeavored to compute. It is a common saying in this region, however, that since 1879 more money has been put into the ground than has ever been got out of it. No consideration of the general interest of the trade or of the risk involved in sinking new wells checks the business of boring.

With a productive territory virtually confined to a few small strips and spots in six counties in Western Pennsylvania and New York, and an inexorable law of rapid exhaustion applying to all wells, the time would seem to be close at hand when this great blessing, the cheap light of the whole civilized world, would fail. Still, the history of the business in the short period since it began has been one of constant expansion. New fields have invariably been discovered when the yield of the old ones began to decline. Oil men have confidence that there is plenty of undiscovered territory yet to be found. Providence they say would not bestow so great a gift upon mankind to withdraw it when its use had become universal, and the need of the human race for its benefits the greatest. Scientists may say that this view is based on an optimistic or pietistic theory of the universe that will not stand investigation. So far as the great stores of fuel and light—the coal and the petroleum—are concerned, it has, however, held good thus far. They have not failed.

Giving Away Gas.

The gas war in Baltimore appears to be as far away from a settlement as ever. The nominal price of gas in that city is $1.00 per thousand; but it is an open secret that either company, in order to take away consumers from its opponent, will supply the article at almost any figure. Indeed, we have it from very good authority that consumers are offered free gas for a period of one or two months, provided they will guarantee to take their supply for a stated length of time from the company offering the bonus. It is also asserted that a similar state of affairs exists in some portions of Brooklyn, N. Y.

The Management of Small Gas Works.

By C. J. Russell Humphreys.

[Concluded from page 58.]

We need say but little relative to the care of the station-meter, pausing only to dwell on two points—namely, that the water be maintained at the true level, and, secondly, that the meter be not overworked.

In order to make doubly sure of keeping the water where it should be, it is generally the custom to fit to the meter, at the correct level, a syphon overflow, and then allow a small stream of water to run through the apparatus constantly. By this means the liquid may always be maintained at one height—that is, the point of overflow. That this device is an efficient one, cannot be doubted. There are, nevertheless, objections to the use of an open syphon in this situation, because the meter is generally in the superintendent's office or an adjoining room, so that in the event of an escape of gas, the remaining factor to cause a disastrous explosion would be conveniently found at some bracket, or perhaps at the photometer. In a word, we deprecate the use of a water joint in any room where a light is permitted. Water lutes are generally termed the safety valves of a gas works, because in the event of any stoppage in the apparatus the gas will blow out at one of these points, and thus relieve the pressure. While this is all very true, we nevertheless demur at allowing the safety valve to blow off where there is a light. So we think, all things considered, a small works can get along without the self-acting overflow. The water can easily be kept at the true level if two points be looked after—first, have a very plain marker at the proper level; secondly, have the cocks of the water and discharge pipes in a handy position. The marker may be a small strip of metal attached to the meter case, and projecting to the water glass, thus showing plainly where the water should be; then, if the regulating cocks are in a handy position, there will be no excuse for allowing the level to deviate from the proper mark. We have only to add on this point that the adjustment of which we have been speaking should be made regularly every morning, and once a week part of the liquid in the meter should be changed by opening the water and waste pipe cocks, so as to prevent the water from becoming foul.

The second matter on which we proposed to dwell in this connection is the speed at which the meter is run. It is poor economy to force any machine; and the remark applies with extra force to this apparatus which is intrusted with the work of measuring the gas. Every meter is designed to make a certain number of revolutions per unit of time, and if the rate be greatly increased the index will not be a correct showing of the gas made. It will, we think, be willingly conceded that any appliance used for measuring or weighing should be perfectly accurate, otherwise its value is of a doubtful character.

The gasholder may next receive our attention, and we would, at the outset, stipulate for a storage capacity equal to the maximum daily outsend, with a leeway of at least 50 per cent. This allowance may seem rather large, but we think it is not excessive for a small works where the variation in the daily demand for gas is frequently a large percentage on the capacity of the plant. The gas holder should receive a coat of tar and turpentine at least twice a year, and the sheets which are oftenest in and out of water may well receive attention four times during the twelve months. Before applying the tar the iron should be well scraped, particularly all rusty spots and blisters. The seams should also be carefully examined, and, if there be the least sign of leakage, puttied up with a mixture of equal parts by weight of red lead, white lead, and litharge. If small holes should appear in any of the sheets, they must be repaired with caution, else the necessity of replacing an entire sheet may stare the manager in the face—a by no means pleasant task where there is but one holder. A handy way to put on a small soft patch is by using tap bolts made of $\frac{1}{4}'' \times \frac{3}{4}''$ rivets.

After the holder has been thoroughly scraped and repaired—if need be—then the tar may be applied, and the hotter the day the better. We prefer tar to paint for the purpose indicated, because there are few if any points which will not peel off after a few immersions in the tank. If, however, the holder is exposed to view, it may be worth while to paint the framework, as by so doing, a more pleasing effect is obtained than if the whole of the iron work were of a somber black color. Under the same head—the care of holders—we would remark that the carriage wheels should be regularly oiled. We do not favor greasing the guide rails of the columns, as the substance is very apt to congeal and form hard ridges, thus doing more harm than good.

In the winter season the holder must be carefully watched to prevent accumulation of snow on it; and particular caution must be displayed when the snow is accompanied by a high wind, as then it will be apt to gather on one side and tilt the holder. It is also necessary, during the same season, to vigilantly guard the water in the tank from freezing. Where a boiler is in use, a small quantity of steam will serve the purpose, only the pipe through which it flows into the water should be pointed not downward, but to one side, around the tank; in this way the liquid will be kept in motion by the force of a very small jet of steam—an eighth-inch opening for a 60-foot tank in an ordinary climate. The gas manager's anxiety during the winter months is greatly lessened if the holder be housed; and we think the custom of inclosing the receptacles, which is confined chiefly to the New England States and the far West, should become general, at least for small works. In factories of considerable magnitude it is customary to have a gang of men whose special duty it is to look after the holders during storms; but in a small concern this labor must be performed by the regular men, and thus the systematical conduct of the works is seriously interfered with. Nor is this all. If a storm come up during the night, when perhaps only one man is on duty, it is a pretty risky piece of business to force that man to leave the boiler and machinery and ascend the holder. Therefore, we repeat, in small works the holder should be inclosed; but the building should be on a par with the purifying house in one particular—namely, that the use of lights therein should be prohibited. The holder should have a scale marked on it so that the quantity of gas on hand can be quickly determined.

Speaking of the general conduct of the works, we would advise that all things be done systematically and in order, and that a perfect record of all transactions and results be kept, so that there may be no doubt as to how things are working. Thus, the coal carbonized each day should be weighed; the number of charges made recorded; the weight of coal charged; the pressures in the different parts of the works, and the reading of the thermometers, should all be noted. The index of the station meter should be taken every hour, and the quantity of gas made compared with the gain shown by the holder, allowance for the differences of temperature being made at the rate of one per cent. in volume for a variation of 5°. Moreover, if the index be noted hourly, any falling off in the yield will be quickly discovered and the remedy at once applied.

For regulating the pressure on the street mains, the governor is to be preferred to common valves, because it is automatic in its action. The counterbalance weights should not be very heavy, as in changing the pressure it is desirable to do so gradually, otherwise there will be a risk of the lights in the vicinity of the governor jumping or oscillating.

In the long run it will pay to have the main pipes of ample area, for if they are small for the work required of them, a heavy pressure will have to be carried, and this means a large leakage account.

Even for the smallest works the leading main should not be less than 6 inches in diameter, and 3 inches should be the lowest size employed. In a district which bids fair to grow rapidly, the outlet from the works should be 10 inches, with 6 inch conduits in the leading streets. In laying pipes the joints should be well yarned; it is not sufficient to merely shove the jute in, but it should be well driven home with a proper iron and hammer.

The lead pot will bear careful watching, for if the metal become too hot the yarn will be be burned. For calking the lead joints, a set of tools, varying from $\frac{1}{2}$ to $\frac{3}{4}$ inch in thickness, with a uniform width of 1 inch, will be handy for a small works. A cold chisel should be the first tool put on the lead joint, and then the sets may be used, commencing with the small sizes.

Blocking mains up to level with stones is rather apt to be a source of danger than otherwise. A better plan is to use earth alone, tamping it thoroughly with a bent iron rammer about 4 feet long, made of $\frac{3}{4}$ inch iron, the lower end measuring 1 by $2\frac{1}{2}$ inches. Mains that are well laid ought to leak but little in country towns, where the roads are not disturbed much; but unfortunately the pipes are frequently put down in a very careless manner, so that a manager finds himself with a heavy leakage account. In such an event, our advice is to stop the escapes; never mind what expense or trouble is incurred in the work. The simplest way of narrowing down the defective parts is to divide the mains into districts by inserting valves at different points. A small pipe should be tapped into the main at each side of the valve and brought to the surface; then, on placing a meter in connection with these two conduits and shutting down the valve, the leakage of the district can be readily ascertained, provided there be no day consumption. If it be impossible to select any time during the 24 hours when there is no gas being used in the section under trial, then the meter cocks at each house can be shut off for the time being. By giving the customers a days notice, and doing work systematically, so that the gas is not off longer than a half hour, little inconvenience will be experienced.

For narrowing down a leak, a good method is to sink steel-pointed bars over the main. The holes should be about 6 feet apart, if the leaks are small ones, and one of the holes should come at a joint, as that is the most vulnerable point. If there be any escape of gas it will be detected by the odor when the bar is removed. Under no circumstances should a light be used in testing for the presence of gas. The leakage per mile of main ought not, in a country town, exceed 5 feet per hour.

As the wrought iron pipes used for services are very easily corroded, it is a wise precaution to coat them before placing them in the ground. A mixture of tar and turpentine does very well for this purpose, provided it is applied a week or more before the pipe is required, thus giving the substance ample opportunity to harden. Some managers use red lead and oil, while others

embed the pipe in building cement. Of course, all services should be laid with a good incline toward the main. It is requisite that a stop-cock be inserted in the supply pipe of all large buildings, at the curb line, for the purpose of cutting off the supply of gas in case of fire. The services, like other pipes, should err on the side of being too large rather than too small. A pipe of ¾-inch bore should be the smallest size used for the purpose.

It can hardly be disputed that the wet meters for private consumers have an advantage over the dry style in the accuracy of their registration; but it is also well known that the former require more attention and are very troublesome during the winter in this climate, so that the dry type is generally preferred; and we think, all things considered, the balance of advantages is in their favor. The caution given, when speaking of the station meter, against working it above its normal speed, applies with equal if not greater force to these "tin boxes," as the facetious consumers are apt to term them. Not only should the meters be worked at a moderate speed, but they should be regularly tested—say once in two years. By the use of a portable test meter, the inspection can be made with the meter *in situ*; but regard must be had to the relative temperature of the two apparatuses. Thus, in very cold weather, or when it is extremely hot, it is well to pass about 15 feet through before commencing a test. We may also remark here, that meters, when out of use, should have the inlet and outlet opening carefully plugged, and be stored in a dry place.

The supply pipe for public lamps should be ¾-inch, and the standpipes of the same size. Where trouble is experienced from the freezing of the lamps in winter time it will pay to make the standpipe 1¼", until it comes above the surface of the ground. The reason for making this suggestion will be appreciated when it is remembered that the most trouble is given by the lamps when there is a thaw after a heavy frost. The theory is that in very cold weather the aqueous portion of the gas attaches itself as small crystals to the side of the pipe; when the temperature moderates, these fall to the base of the pipe and form a solid mass at the elbow. If the tubing near the elbow be of 1¼" diameter, there is much less chance of the accumulation of ice shutting off the gas.

The lamp posts should be furnished with lever-cocks, which admit of the lighting being done without the aid of ladders. Cocks of the ordinary style can be converted into levers by riveting on a strip of brass 1-16" thick and ¼" wide, bent to the proper shape. The size of street lamp burners for general lighting varies from 3 to 6 feet an hour; for small towns a consumption of 4 feet an hour per lamp is ample.

Finally, in closing, we wish to say a few words on the general conduct of the gas business.

The first point on which we would touch is the desirability of selling as much gas as possible, because the profits are increased in a greater proportion than the sales. This is accounted for by the fact that the fixed charges of a gas company are a very large percentage of the total expenditure. We may safely say that most small works could increase their outsend by 20 per cent., the only additional expense to which they would be put being for the coal and lime. In works of the size we are considering in these articles, the cost of the two materials mentioned will be about one-fifth of the total expense of making and delivering the gas. Thus if a=the selling price per 1,000 feet, b=the total cost per 1,000 feet, then the ordinary profit will be $a - b$. But on the extra quantity sold the gain will be $A - \frac{b}{5}$.

Let a manager substitute the proper values for his own company for these figures, and he will appreciate how infinitely it is to his advantage to increase the sale for the gas he makes.

We now come to the question, how may the demand for gas be encouraged?

First, the main efforts of the manager should be devoted to extending the consumption of gas for lighting purposes, and the point should be constantly borne in mind that gas companies are incorporated for supplying light; and it is this branch of the business which will be the mainstay of such concerns for some time to come. In this connection we would say that the demand for gas in a country town will not increase rapidly if the manager fail to teach his customers how to burn the light-giving substance he sells them, for ignorance of the principles underlying the combustion of gas begets a poor light and a large bill. This means dissatisfaction on the part of the consumer, and a manager may rest assured that such a party will be a very poor advertisement for his business. On the other hand, if a person obtain, by the use of good burners and globes, a satisfactory light, the fact will doubtless make itself known before long on the application book.

The main point of a good burner is that it be so constructed as to permit gas to issue with very little pressure at the tip. For the flat flame type, this principle is well illustrated in the Bray special, and the Young America with E H lava tips is well worthy of mention; the same may be said of the Empire. The Sugg D is justly entitled to the first place among Argand burners, and it, as well as those before mentioned of the flat flame type, will give a good light, if there be any virtue in the gas consumed. For general lighting purposes the form of burner first alluded to is to be preferred, and this class of burners may be further divided into three sections: the batswing, fishtail and excavated head (sometimes called E H tips). We favor the latter kind.

The one requisite in a glass globe is that it have an opening at the bottom at least 4 inches in diameter, and if the aperture be increased by one quarter, so much the better. A gas manager should keep such articles as we have just been speaking of on hand, and should sell them to his customers at cost price, so that there may be the least possible excuse for the retention of old or defective fixtures. By attention to these points, and by supplying a good gas at a reasonable figure, it will be found that even in small towns the use of gas lighting can be considerably extended, whereas if they be neglected, or an inferior gas supplied, or the charge be unreasonably high, the lamp man with his improved burners and well refined oil will have the bulk of the lighting business.

The only way to introduce gas for cooking purposes in a suburban town is to bring the stoves before the people so that they may have occular, and we might add palatable, proof of the capabilities of these cookers. A ready way to carry out this idea is to send a party around among the consumers with a small stove, explaining and showing it in action to each resident. If then a small stove were left on trial wherever a customer would receive it, the use of gas for cooking purposes would be rapidly increased.

Some companies have found the gas engine business the most valuable of auxiliary branches of the gas industry; but the extent to which this department can be pushed will be greatly dependent on the character of each town. If in a given village there be several small factories and printing offices, then the gas engine can be made to contribute largely to the gas company's revenue.

How Ammonia is Lost in Gas Works.

Mr. J. Alfred Wanklyn contributes the following to the London *Journal of Gas Lighting:*

"It is well known that the ammonia is almost perfectly removed from illuminating gas before the gas is supplied to the public, and in many gas works more than 95 per cent. of the ammonia which existed in the crude gas is removed before the gas leaves the works. But it would be a mistake to assume that 95 per cent. of the original ammonia is rendered available for industrial purposes. What really takes place, to some extent, is that the ammonia is transferred from the gas that is inside the pipes to the atmosphere outside.

"The escape of ammonia from the tanks in which the gas liquor is preserved is a quite appreciable quantity, as may be seen from the following: In gas works, open tanks, although rare, are not altogether unknown. Some of these are placed on the roofs of buildings, others on the ground, or practically on a level with the ground; but by far the greater number of tanks containing gas liquor are partially closed in. Instances of liquor tanks perfectly closed in are to be met with. Assuming that the tanks contained water, the rate of evaporation is pretty well known; and, on reference to standard authorities, the following statement will be found to be sufficiently correct: The rate of evaporation varies with the season of the year, being greater in summer than in winter; and the average evaporation from a perfectly open tank, freely exposed to the atmosphere on the roof of a building, is about 1 inch per week. The average rate of evaporation at the surface of the ground is 0.5 inch per week, and the rate in the partially covered tank 0.25 inch per week.

"As a matter of fact, the gas tanks are charged with a dilute solution of carbonate of ammonia and sulphuret of ammonium; and these salts will evaporate very much faster than the water in which they are dissolved. I have made some experiments, and I have found that these salts, when in solution in water, evaporate some 15 to 20 times as fast as the water. Let us, then, take the case of the liquor tank on the roof of the building. We assume that the liquor in the tank is constantly renewed. Under these circumstances, when the liquor diminishes in volume to the extent of 1 inch, it will lose the volatile ammonia which was contained by 15 or 20 inches of liquor. In the case of the open tank on the ground, the loss of ammonia per week would be expressed by 7½ to 10 inches of liquor. And in the case of the partially closed tank the loss would be 3¾ to 5 inches. From these figures it may be judged how very serious a matter this loss of ammonia by evaporation in tanks becomes."

English Brick for Oregon.

The full-rigged ship Morayshire, of Glasgow, 1,428 tons, sailed from Leith recently for Portland, Oregon, with 1,485 tons of brick, 360 tons fire-clay and 220 tons cement, being the largest cargo of that kind ever shipped from that port.

[From the Review of Gas and Water Engineering.]

The Construction of High-Power Burners for Heating; with Suggestions for Increasing the Day and Summer Consumption of Gas.

By Thos. Fletcher, of Warrington.

[Considering the importance of these subjects to the American gas engineer, we feel warranted in reproducing the above-named paper, which was read by the author at the Sheffield meeting of the Gas Institute.]

The laws governing the details of burners consuming a mixture of gas and air have never been studied from a constructive point of view, and many gross errors are constantly being committed.

The first and most important part is the mixing chamber or tube, one end of which is supplied separately with gas and air, which at the other end are, or should be, delivered as a perfect mixture. It may be taken as a rule that this tube, if horizontal, should not be less in length than 4½ times or more than six times its diameter. It is a common practice to diminish or make conical-shaped tubes. All my experience goes to prove that, excepting a very trifling allowance for friction, the area of the smallest part of the tube rules the power, the value of the mixing tube being no more than that of the smallest part. If the mixing tube is upright, new sources of interference come in; notably the varying specific gravity of the mixture. Except with one definite gas supply, the result is always more or less imperfect, and regular proportions cannot be obtained. This is now so well known that the upright form has been practically discarded for many years, and is now only used where the peculiar necessities of the case give some special advantage.

The diameter of the mixing tube is a matter of importance, as it rules the quantity of gas which can be satisfactorily burnt in any arrangement. With large flames, given a certain size of gas jet, the diameter of the mixing tube should not be less than 10 times as great. For instance, at 1 inch pressure, a jet having a bore of ½ inch will pass about 20 cubic feet of gas per hour. To burn this quantity of gas, a mixing tube is necessary of 10-8ths or 1¼ inch in diameter. By the first rule this tube must be in length equal to 4½ times its diameter, or 5⅝ inches. It would appear that the mixing tube, having 100 times the area of the gas jet, is out of all proportion to the size necessary for obtaining a mixture of 1 of gas to 9 or 10 of air; but it must be remembered that the gas is supplied under pressure. It is therefore evident that no mere calculation of areas can be taken into account unless the difference in pressure of the supply is also considered. A complete reversal of this law is shown in that ruling the construction of blowpipes, which I have already given in a previous paper. In these the air supply, being under a heavier pressure, is much smaller in area than the gas inlet; and, to obtain maximum power, the air jet requires to be enlarged in proportion to the gas pressure.

Given a certain area of tube delivering a combustible mixture, the outlet for this mixture must be neither more nor less than the size of the tube. Taking an ordinary drilled tube, such as is commonly made, and of the dimensions before given—that is, 1¼ inch bore—if the holes are drilled ⅛ inch in diameter, the tube will supply $10 \times 10 = 100$ of these holes. In practice this rule may be modified.

The variations from the rule, however, must be a matter of experience with each form of burner. There is also the fact that with small divided flames it is not necessary to mix so large a proportion of air, as each flame will take up air on its external surface; but in this case the flames are longer, hollow, and of lower temperature. As a matter of actual practice, where a burner is used which gives a number of separate flames or jets, the diameter of the mixing tube does not need to exceed 8 times the diameter of the gas jet; the remainder of the air required being taken up by the surface of the flames.

Wire gauze, of the strength I shall specify further on, has an area in the holes of one-fourth its surface. By calculation, the area of a gauze surface in a burner should therefore be taken at 4 times that of the tube, and our standard of 1¼ inch tube requires a surface of 2½ inches in diameter. This rule is subject to variation in burners of a small size, owing to the air that can, if required, be taken up by the external surface of the flame, which, of course, is much greater in proportion in a small flame than in a large one. Where the diameter of the gauze is, say, not over 1 or 2 inches, the theoretical gas supply may be exceeded, and a varying compensation is necessary with each size. My rule is intended to apply to burners of larger diameters, where the external air supply plays a comparatively unimportant part.

If you will remember the ordinary form of gauze burner which has been universally accepted, and compare it with the very unusual appearance of a theoretically perfect form, you will understand the reason why, in designing the proportions of the "solid flame" burners (which so many makers have done me the honor of copying) I departed so seriously from a really perfect form. In the then state of knowledge and ideas of gas heating, a perfectly proportioned burner would, I think, have been regarded as an absurdity.

I have here some roughly-made samples of burners, theoretically correct in form and proportions; and you will be able to judge of their power. The smallest, which is 2½ inches in diameter on the gauze surface, will burn, at 10-10ths pressure, 20 cubic feet of gas per hour, giving a perfectly solid flame of a very high temperature. At 30-10ths pressure the consumption is nearly double, with a subdued roar. Of course, as we increase the temperature of the flame and reduce its size, we get a greater power of obtaining higher duties in practice; and we are able to reduce to dimensions previously undreamt of the size of apparatus for specified purposes.

The evil of gas heating as practically applied has been that, as a rule, makers have been content with copying each other, and perpetuating errors which have come at last to be almost accepted as truths; few having cared to attempt to study the matter theoretically. Perhaps the only worthy pioneer of a new era has been Mr. Wallace, who was the first to see the value and necessity of properly proportioned mixing chambers; and my own experiments have only been a persistent following up of Mr. Wallace's original idea, so as to carry it out to its fullest extent, and make the forms such as were generally useful.

When we get perfectly explosive mixtures of gas and air which require to be burnt quietly and safely, it becomes necessary that some method shall be adopted to prevent explosion or lighting back in the mixing tube. When a short flame is required, it is absolutely necessary that the holes or perforations shall be small; and a rule which is applicable to upright holes, does not work with horizontal ones. For instance, it will be found that holes ⅛ inch in diameter and 4 diameters long will burn, without risk of lighting back, a mixture which constantly explodes if the same holes are upright. The holes which, horizontal, require to be 4 diameters long, need to be 6 or 7 diameters long if upright, so as to burn the same mixture safely. The reason is simple. An explosion in an upright tube runs down the center; whereas in a horizontal one it runs along the upper surface of the tube, in contact with the metal, and is therefore more rapidly cooled and extinguished. For drilled burners there are, I believe, only two materials known which are worthy of mention—either close-grained annealed cast iron, or wrought iron with steatite or porcelain nipples inserted. Either of these is practically everlasting.

The objection to drilled burners for boiling purposes is that the cones of flame are hollow, unless a perfectly explosive mixture is used, in which case the burner is liable to light back. This admits of remedy by the insertion of a gauze diaphragm in the burner. This, however, entails extra complications, and necessitates objectionable joints and liability to leakage. As usually made, the flames are hollow, and the hollow part enlarges as the burner gets hot. When any part of the hollow flame comes in contact with a comparatively cold surface, there is always an escape of partially consumed gas, and a subsequent smell. This difficulty I have to a great extent overcome by cutting narrow slits in the cast iron, which, owing to their small width, admit of a more explosive mixture being burnt quietly, and this practically does away with the hollow part of the flames. Where a burner is not used for boiling, but for the production of heated air, a drilled burner with round holes may be a distinct advantage, as, by proper construction, it may be made so that the burner itself never gets overheated. This is a great advantage in ovens, where the burner is liable to be splashed with fat, which, dropping on a very hot burner, makes a most offensive smell.

These arrangements only supply us with burners giving a diffused flame spread over a comparatively large area, such as are specially adapted for cooking and most domestic purposes. When we want really powerful burners in a compact form, and flames of a high temperature, we are driven to the use of finely perforated materials. The material first used was wire gauze, which was found to rapidly choke up and rust or become destroyed. I believe Mr. Wallace was the first to introduce perforated copper, and this was found to scale rapidly and disintegrate. By the application of a thick coat of metallic nickel by electro deposition, I succeeded in overcoming this objection and extending the average life of one cap or perforated plate to years instead of months; but still this material has one serious fault for high power burners, in the fact that it is not possible to increase the area of the perforations beyond a very limited extent. It will be at once seen that the larger the perforations, and the closer they are together, the greater the quantity of mixed gas and air which can be passed through. To obtain a free way, I have been compelled again to return to the discarded wire gauze, and after a very long series of experiments have found that the largest mesh which can be used with a perfectly explosive mixture is made with wire of No. 22 iron wire gauge and 20 wires to the linear inch. This may be taken as a standard for all gauze burners with horizontal mixing tubes. If the tubes are upright, a much closer mesh is necessary, as the mixture cannot be controlled so well under all conditions.

The difficulty remains that copper and brass wire quickly disintegrate, and iron wire both retains dirt and is very liable to rust. There is, however, a very simple remedy for this, which consists in tinning the gauze, after weaving, in a bath of pure melted tin. This process enormously strengthens the

gauze, and produces a surface which is self-cleaning and perfectly satisfactory in every way.

It must be remembered that burners of this class, which burn without the necessity of an external air supply in a flame which is solid, require the mixture to be correct in proportions. A very slight variation makes an imperfect flame. Not only does the gas jet require to be adjusted with great precision, but it also needs more or less adjustment for different qualities of gas. An ordinary hollow or divided flame is able to take up on its surface any deficiency of air supply; but with the high power solid flames the outside surface is small, and the consequence is that one of these burners, adjusted for gas of poor quality, may, when used with rich gas, give a long hollow or smoky flame, unless the gas jet be reduced in size. When perfect, the flame shows a film of green on the surface of the gauze; and if a richer gas is used the green film lifts away. To cause this to fall again and produce a solid flame, it is necessary to take out the gas jet and tap the end with a hammer, until on trial it is found to be correct. If too small, the green film lies so closely as to make the gauze red hot. Where the "tailing up" of the carbonic oxide flame is objectionable, there is no practical difficulty whatever in constructing these burners as a ring, with an air supply in the center, which greatly reduces the length of the "tail." I have here a sample of the same burner made in this manner; and, of course, it will be seen that it is no difficult matter to make burners that will give flames of any required shape. I have more than once made them with flames up to 7 feet in length in one burner. In practice it is a decided advantage to have a center air-way in all burners of more than about 2 inches in diameter, as it enables the injecting tube to be slightly shortened, and lessens the liability of the green film to lift with varying qualities of gas. In this class of burner I have adopted the small central air-way as a decided improvement in the practical form of the burners. As these burners will perhaps be a curiosity to many of those present, I shall be pleased to send one to any member desirous of testing its capabilities.

As no doubt many of you are aware, I have constructed a great number of large burners for experimental purposes, including a quantity as large as 2 feet in diameter. Now, as experiments have shown that with a burner constructed in correct theoretical proportions, in the form I now show you, each circular hole will burn about 3 cubic feet per hour, we obtain by circulation, in a 24 inch burner, a consumption of more than 1,700 cubic feet per hour, taking the whole capacity of a 300-light meter, and capable of raising steam for about a 22-horse power engine. I have never attempted to test so powerful a burner, the largest yet made in this form, according to the present calculations, being 10 inches in diameter, which I find requires a gas jet of ¼-inch bore at the nozzle, and a 2-inch main; the consumption being, by calculation, about 300 cubic feet per hour. All experiments have been made and figures taken from burners made in sheet iron, with a smooth surface. For the larger sizes of such burners as I have been describing there is at present little demand; they exist as curiosities. But it is certainly as well to be in advance of our customers' requirements, and to be able to do more than they want.

I have here also a star burner, made according to correct proportions, for working steam engines and large stills. In this case not only is an indestructible burner required for use in dirty places, but also one which will, if necessary, burn unpurified gas. The flame is neither so compact nor so hot as that of the gauze burner, but it has special advantages; and the measurements are worth recording as standards for reference for burners of this class. The mixing tube is of 5-inch bore and 23 inches long; the rose is 16 inches in diameter, with 32 jets, each of ⅛-inch bore. With 18-candle gas, it takes a gas jet of ¼-inch diameter, passing about 500 cubic feet per hour. If used with gas from the Wilson or Dowson producer, the gas jet needs to be enlarged to ⅜ inch; giving a correspondingly larger consumption.

In this class of burner there is always a practical difficulty in turning the flame low, owing to the risk of lighting back. If purified gas is used, the remedy is to interpose a disc of wire gauze, of sufficiently large area, in the body of the burner; but there is also a remedy with burners used for unpurified gas. The risk of lighting back increases in about the proportion of the square of the smallest diameter of the hole; and the holes may be arranged in a series of either horizontal or vertical slots, which can be again subdivided by feathers. By this arrangement it is possible, without reducing the area of the flame exit, to reduce the actual distance of the metal surfaces from each other from ⅜ to ¼ inch, or even less, greatly reducing the risk of firing back, and enabling unpurified gas to be used in a burner which can be turned low and yet burn steadily. You see here examples of a burner made in this way with both vertical and horizontal slots.

Evidently the principle is applicable to burners of any size and any power, without practical limit, and no alteration is necessary. For its power, it is a very easy burner to make; and it cannot well be either destroyed or damaged. By adjusting the slide, it will, without enlarging the jet, burn either poor hydrocarbon gas or generator gases of any composition or quality, whether purified or not; as, even if choked with tar, it is exceedingly easy to clean. When used for purified gas, it is perhaps better to interpose a sheet of wire gauze between the flame and the mixing tube, to enable the flames to be turned down to any extent without risk of lighting back if used in a draughty place. As, of course, this burner admits of being made of any shape and any size, it is possible that it may, in one form or another, find work in heating retorts by the use of "producer" gases, and it must also be remembered that, provided an air supply under pressure is available, the power of any burner may be increased to any extent almost without limit, simply by supplying air under pressure at the usual gas inlet, and admitting the gas through the larger opening in the side of the mixing tube, where air is usually drawn in by the inject power of the gas pressure. With this arrangement it is quite easy to increase the power of any burner twentyfold, or even more if necessary. In fact, I have here a gauze burner of 1 inch surface, which, with a small foot-blower, can be made to consume more than 60 cubic feet of gas per hour in one small flame, which fuses steel with ease.

It is of little use talking of large burners unless the gas required for them can be obtained at a cheap rate. To do this, the first necessity is a large and steady summer and winter demand. Both plant and men must have regular work if cheapness is to be attained. A few gas engines and a few hundreds of cooking ranges may be something; but we must strike out in a totally new line if the day consumption of gas is to be anything really worth having. My own employees, I believe, without a single exception, are, of their own choice, good customers for gas for cooking purposes. They see and know, of their own knowledge, that it pays them to use it, and that it is a good, cheap servant. Their example spreads to their friends and acquaintances; and, although a prophet is supposed to have "no honor in his own country" or town, I think more has been done in Warrington in the same time, by Mr. James Paterson, the engineer of the Corporation Gas Works, to increase the use of gas than in any other town of its size. The practical effect has been curious. The increase on the part of the Corporation has been purely in cooking apparatus; whereas my own "effect" has been to increase the commercial to a much greater extent than the domestic use—not as to number of consumers, but as to quantity of gas consumed. This side of the question is, I think, one of deep importance, as it includes, or will eventually include, a great number of valuable customers using gas largely. Our own "commercial" use of gas for the past four years has about doubled every year; and we are only one of a very large possible number willing to do the same thing.

If I were to attempt to create a day consumption of gas, the first thing I should do would be to offer to fit in every house—for nothing or next to nothing—a good, cheap boiling burner; the first samples being fixed in the houses of every one of the gas works employees, so that they could both preach and practice. This could be done for an average cost not exceeding 4s. or 4s. 6d. for each house, including all expenses. If the people objected, I would send a man round who understood the matter and could talk, to show them the advantage and saving of time and dirt that would result from its use, and to explain that it would cost nothing and eat nothing if not used. I have no doubt that I am well within the mark in saying that, properly managed, these burners could be got into at least half the houses in any district within six months, and that the value of the additional gas consumption would average fully 300 per cent. per annum on the first outlay. It would also be a consumption of exactly the right kind, averaging much more in the summer than in the winter. I have already suggested this to many gas engineers, and the idea has been taken up at once, not only by those to whom I have mentioned the matter, but also by their friends. The system is already on its trial so far as this is concerned, and apparently will rapidly become general. A large proportion of those who tried one burner would very soon want to extend; and when once a willing customer who had a little experience was secured, further transactions would very likely be exceedingly satisfactory to both.

It appears to me that there is no necessity whatever to attempt to push the use of heating stoves. The majority of people are only to ready to adopt them, so far as they can afford; and many adopt them only to discard them again after the first bill. As a fuel for heating large air spaces, gas, at its very best, is costly, and will remain so until we can get it at about 1s. per 1,000 cubic feet, or less—not a very likely event at present. The worst of the stove and fire consumption is that it increases the irregularity of the make, this being purely a winter service. Expensive gas heating is far more universally accepted than cheap gas cooking, and a saving which would be utterly ignored in a stove is made a matter of extraordinary importance in a cooking range. It appears to me, from experience commercially, that people who expend without question shillings daily for gas for a stove for heating, consider seriously pence for cooking purposes. Perhaps it is because the "male persuasion" generally control the heating department, and the female the cooking. Certainly there is an extraordinary difference, and a wasteful stove is easier to sell than an economical cooking range; prices being equal or in favor of the cooking arrangement as regards first cost. People do not need education as to buying gas stoves for heating, while they certainly do

as regards cooking—the very point in which gas excels every other fuel in every possible way.

There is an enormous dormant demand for gas heating for workshop and commercial purposes, which, as yet, has not been touched to any appreciable extent, and I am afraid will not be touched until the staff of each works is increased by an official who shall be conversant with the practical application of gas as a fuel for general commercial purposes, and be able to advise, and if necessary construct, special apparatus for special purposes. A first step would be to introduce into your own workshops all appliances for gas heating likely to be useful, and allow them to be seen. My own workshops are, as they always have been, open to all, and in case of inquiry for any special apparatus—a matter of daily occurrence—I endeavor either to show what we use for similar purposes, or to devise roughly a cheap experimental form of what is required, so that a test can be made at a small cost without delay. The practical consequence has been that the use of gas for commercial purposes has increased enormously. To give one example out of many, a well-known firm of wire cable manufacturers have been in the habit of brazing with small forges the wires for cables. An experimental blowpipe was designed for them at a cost of a few shillings, and now they have in use throughout the day at least 20 of these appliances, doing the work better than the forges at less than half the cost, and (what is more to the point) using throughout the year some 2,000 cubic feet of gas per day for this purpose only. This firm has set an example which others are quite ready to follow; and the same apparatus is now in use nearly all over the world. Tons of short lenghts of wire, not worth using under the old system, are now being worked up at a profit into cables, and everybody concerned is benefited all round.

Assayers and metallurgists, who have used coke all their lives, are ready and willing to use gas, so long as they know it will do their work; and they are both large and valuable customers. Plumbers, printers, and stereotypers, and a hundred of other trades, use gas as a fuel when they know its advantages; and where it is employed for business purposes one customer is generally worth from a dozen to fifty private users for cooking and domestic service. All that is wanted is in each center a place where reliable information, obtained by practical experience, can be procured; and the proper source of this information is most certainly the gas works. It is not worth the dealer's while, for the sake of a few shillings profit, to go to any great trouble to introduce a new thing; the profit mostly going to the makers of the gas, who obtain a permanent income out of the transaction.

I am convinced that distinct and immediate results would be realized in the increased demand for gas by the employment of an efficient man, whose duty it should be to go round and introduce into every house and every works the use of gas for heating in some form. To do this, he must know what he is talking about; and his efficiency and permanency might be easily decided by his success in obtaining customers. Pay him, if you like, a small salary, and a large commission on the increase of the gas bills, or in any way preferred. The best man, if he is educated to the work, is the meter examiner. He is on the spot, and, other things being equal, would have a greater advantage than a stranger. There is no possible doubt that when you want it a very large consumption is to be had for the asking, and of a class which is exactly what you require—steady throughout the year, and larger in summer than winter.

A good source of profit is the consumption for gas engines; but the use of these is at present limited by their excessive first cost. So long as a steam engine can be fixed for half, or less than half, the first cost of a gas engine, the latter is too heavily handicapped; and I offer it as a crude suggestion that the gas companies should jointly copy the system of the Society of Arts, and offer a prize well worth having for a gas engine, satisfactory in all points, which should cost no more to fit up than a steam engine. A prize of £10,000 would be exceedingly well expended on this, and would be a trifle to each subscriber to the fund. It would certainly make a move in gas engines, and stir up the makers in an astonishing way; and a subscription of about £7 from each gas works would cover the total cost.

We use gas as a fuel largely, both in our own works and for domestic purposes, and we only use it where it pays. At least one-half our total consumption is for furnaces and blowpipes—brazing, forging, boiling and evaporating, cooking, warming-stoves, bath heating, and similar purposes—and our requirements are by no means exceptional. What we ourselves do is nothing more than what everyone else would do, providing the matter were fairly put before them, and its advantages demonstrated. It is far more profitable to double the consumption of gas in each building than to put in new mains, service pipes, and meters to double the number of houses, irrespective of the extra cost of inspection, repairs, and office work, all of which would be saved.

In conclusion, let me put on record the result of some experiments made with gas ovens, which will be of interest to all. It is generally acknowledged, without question, that an oven lined with slag-wool is the best, because it is supposed to "save 40 per cent. of gas," and do other wonders. Now, the average cost of gas for oven work in a private house will not exceed, at the most, about 15 or 20 cubic feet per day. A saving of 40 per cent. on this, even if it existed in practice, would not be particularly important to any one except the very poorest. I took a common cast iron oven, 16 inches square and 20 inches deep, weighing 1 cwt. 2 qrs. 15 lbs., and inserted an ordinary Bunsen ring of good construction in the bottom. With free ventilation and a gas consumption at the rate of 14 cubic feet per hour, I obtained the following temperatures in the center of the oven:

In 3 minutes.....	250° F.
" 5 "	300° F.
" 8 "	360° F.
"12 "	400° F.

With a consumption of less than 2 cubic feet of gas, I got up a common heavy cast iron oven—freely open to the air, and not jacketed in any way—to a first-rate heat for pastry, and in perfect working condition. It is evident that such an oven, of good capacity, can be heated to a good temperature for roasting meat, every day for a week, for a cost of one halfpenny or less per week. These experiments were made with an oven in practical working condition, with three strong shelves, one being between the burner and the thermometer. The apparently extraordinary result can, I think, easily be accounted for by the fact that iron does not take up heat at all readily or quickly, and makes a good retainer of heat. The outside of the iron is a long time before it becomes even warm to the hand. In the same oven, with the same burner placed at the top, and with equally free ventilation, the heat obtained, as shown by the same thermometer in the same position, was as near as possible one-half; showing that deflected heat (which is beyond comparison the best for roasting and grilling) costs about twice as much for the same result, provided the heat above the burner is not utilized in any way. One curious point is the fact that the burner at the bottom of the oven, which is supposed to have 183 lbs. of cast iron to heat up before it can do any work, gives in immediate results about twice the actual work of the upper burner, which is supposed to have nothing to heat up as a preliminary.

We use our ordinary fire-range oven to a great extent with gas instead of a fire; and, except for pastry, the burner appears to be always turned down after the first five minutes, to as low a point as it will steadily burn at. If a heavy cast iron oven is wasteful as a gas oven, the waste is so small as to be hard to discover; and certainly, when we take into consideration the indestructibility and low first cost, I believe it will be found far cheaper in practice than the ordinary jacket form. The only difficulty will be to convince people who are unable to judge that such a reversal of the accepted ideas can be true; but I am disposed to venture on the prophecy that within ten years from the present date simple cast iron ovens, unjacketed and unprotected in any way, will have come into very extended use for gas cooking.

Discussion.

M. C. E. Botley (London) said they were all agreed that the importance of the matter should not be overlooked, and the increase of the consumption of gas for cooking and heating purposes was greatly to be desired. It had of late been slowly but surely making its way in this direction; but he could not agree with the author of the paper that they ought to push their business by placing their officials on the same footing as a photographic tout. That would prejudice the public mind against the use of gas for cooking and heating. One thing he regarded as important, and that was the use of an air supply under pressure. Without attempting to disparage the efforts of Mr. Fletcher in that direction, he might say that the system had been in use for some years at the Great Western Locomotive Works, at Worcester, for taking off and putting on tires at a very small cost. The gas was taken from the ordinary service pipe, and the air from the blast supplying the furnace. By this means much expense was saved, and the method was much better than the old one of putting the wheels into furnaces.

Mr. Carr (Halifax) was also of opinion that the subject was of great importance. They were all anxious to increase the consumption of gas, particularly in the day time and in summer; but he did not know whether they could all go so far as the reader of the paper in recommending the sending of men to sit upon door steps until people could be induced to take a burner of some kind. They would, no doubt, all do what was rational to obtain a further consumption of gas for cooking and heating. He would like to have heard the experience of managers as to the best kind of stove, for they were not so much interested in the matter of construction as in the merits of the stoves at work. Where he was engaged they let out stoves readily, and they appeared to give general satisfaction, while they did not find it necessary to make any great exertions to push the business. The consumers heard from one another about it, and that was the best way. If they forced the stoves upon them, the gas bills, where gas was used lavishly, would be detrimental to any company or corporation.

Mr. Foulis (Glasgow) referred in terms of praise to Mr. Fletcher's remarks on burners. The wider question of stoves was incidental rather than con-

nected with the paper. The experiments made by Mr. Fletcher must be of great interest to all connected with gas, and no doubt they opened up quite a new field for the use of gas. Mr. Fletcher was certainly entitled to their thanks for what he had done.

Mr. Travers (Cork) felt great interest in Mr. Fletcher's paper, and he was very glad he recognized the fact as put forth in a paper read by him (the speaker), that the Wallace burner was the one to give the highest amount of work. He wished to ask if, in Mr. Fletcher's experiments, the thermal power of the gas increased in proportion to the volume consumed. The pressure was stated to be 10-10ths; but he had found stoves work at 6-10ths and 7-10ths pressure, and the great object should be to get a power of work at a lower pressure than 10-10ths. It was very well to tempt large consumers by giving free stoves and fittings; but it struck him that they ought to be in a position to supply gas for manufacturing purposes at a lower rate.

Mr. Fletcher, in his reply, stated that in actual practice the thermal power increased with the temperature of the flame, but not in the proportion the lighting power did.

The President remarked that what had been shown proved the capability of gas in manufacturing purposes as well as in household use, and it was clear that in future—perhaps in the near future—quite a revolution would be brought about in heating power. As to the latter part of Mr. Fletcher's paper, bearing upon a criticism of what Mr. Stevenson, of Peterborough, read at the Midland Association, he wished to say that Mr. Stevenson did not intend such conclusions to be drawn from what he said that Mr. Fletcher had drawn. He gave the results of his own work and extension of gas consumption at Peterborough. He did not agree with the conclusions Mr. Fletcher drew; but of course you are all aware that he had no intention of doing anything unfair with regard to Mr. Stevenson's paper.

Improved Gas Burners.

The *Journal fuer Gasbeleuchtung* contains an account of some experiments on improved gas burners which were recently conducted by Dr. Engler and reported to the Karlsruhe District Society of German Engineers.

The first form of burner experimented upon was the Siemens burner, pattern No. IV., which is familiar to our readers, with the following result:

Gas Consumed per Hour, Cu. Ft.	Candle Power.	Gas per Candle per Hour in Cu. Ft.
8.99	39	.230
8.87	35	.253
8.59	34	.252

By way of comparison tests were made at the same time with various other forms of burners with the following result:

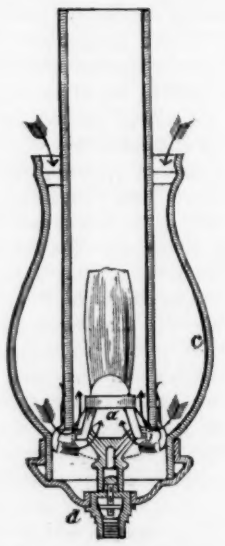
Style of Burner.	Gas Consumed per Hour per Cu. Ft.	Candle Power.	Gas per Candle per Hour, Cu. Ft.
Batswing.....	6.88	17.0	.404
Fishtail.....	5.40	11.0	.491
Argand.....	6.99	18.5	.377

These observations were made with the Bunsen photometer; the standard candle of the German Gas Managers' Association being used. Attention should be drawn to the fact that in these tests the Siemens burner is subject to the disadvantage that not more than two-thirds of the flame is effective, inasmuch as the porcelain cylinder of the lamp cuts off a part of the light which does not strike the photometer disc.

Hence it appears that for a given consumption of gas the light of a Siemens burner is equal to at least twice that of the usual forms of burners, while the useful effect in actual use is still greater for the reason just given. Indeed, it will bear comparison in the point of cheapness even with petroleum oil. In all localities in which a ready removal of the products of combustion can be secured, these regenerative burners can be used to a great advantage, more especially for lighting large public halls, workshops and the like. The usual mode of lighting auditoriums by means of sun burners, of from 20 to 100 lights, placed in the ceiling, can be effected by means of Siemens burners with a gas consumption of about one-third.

In spite of all the advantages, however, peculiar to the Siemens burner in so far as intensity of light and economy are concerned, it cannot be denied that it is open to the objection of being applicable only in case the gas consumption is not less than about seven cubic feet per hour; again, the necessity of using a large and unsightly metal chimney and of discharging the products of combustion out of the room, often becomes a serious objection.

To overcome this, Mr. C. W. Muchall, of the firm of Muchall Brothers, Berlin, has devised a burner, also based upon the regenerative principle, which can readily be applied to burners of small size and in which the draft is created by an ordinary glass chimney; it is a decided step of progress in domestic lighting. The accompanying cut shows the burner in vertical section. It consists of an ordinary Argand burner *A* with its glass chimney B; a bell-shaped glass globe *C* surrounds this chimney, being secured and cemented into the socket *D*. The air supply follows the direction of the arrows, being compelled to strike the hot chimney *C*; this heating intensifies



the combustion, and perceptibly increases the illuminating power. Experiments made with it gave the following most satisfatory results. By way of comparison the globe *C* was removed, thus making it practically an ordinary Argand burner.

	Gas Consumed per Hour, Cu. Ft.	Candle Power.	Gas Consumed per Candle per Hour, Cu. Ft.
With globe.....	4.16	13.5	.308
Without globe.....	4.16	10.5	.396
With globe.....	4.58	16.1	.284
Without globe.....	4.58	11.6	.395

Experiments made elsewhere with another Muchall burner gave the following result:

	Cubic Feet.	Candles.	Cu. Ft. per Candle.
With globe.....	4.58	17.7	.259
Without globe.....	4.58	11.2	.409

Although the new burner does not attain the efficiency of the Siemens burner, these experiments show it to be from 30 to 50 per cent. more efficient than the Argand and the best types of ordinary burners. Its compactness, simplicity of construction, and consequent small cost, render it peculiarly valuable for lighting small localties like workshops, salesrooms, dwellings, etc.

The author also speaks of some tests made of a Morley burner, an English invention; in this, two small "lava-tip" Fishtail burners are so placed that their flames are parallel though slightly inclined to one another, so that they unite at their tops to form a somewhat peculiar flame; the forced motion of the gas and air as a result of this contact, intensifies the illuminating power. The following is the average of three tests: Gas used, 3.9 cubic feet per hour, 11 candle power, making the amount of gas used per candle per hour .35 of a cubic foot, thus giving a higher value than any of the old forms of burner.

During the discussion of this paper the fact was announced that the burner, devised by the French electrician Clamond, in which gas heated to 1850° Fahr., is supplied under a pressure of about 5.8 inches of water and the products of combustion directed upon a piece magnesia, gives the following result:

Gas Consumed per Hour, Cu. Ft.	Candle Power.	Gas Used per Candle per Hour, Cu. Ft.
17.6	18.0	.09
6.35	4.1	.155

Value of Gas as an Illuminant for Lighthouses.

The London *Telegraph* has received a long letter from Professor Tyndall on the progressive improvement in the system of illuminating lighthouses, dwelling on the remarkable achievements of Mr. Wigham in this respect in Ireland, in reference to which Mr. Tyndall had made very careful personal inquiry, and had strongly recommended those inventions to the Board of Trade. Mr. Wigham's latest adaptation of gas as a lighthouse illuminant Professor Tyndall speaks of in very high terms for its brilliancy, especially commenting on the fact that it is visible at a greater distance in foggy weather than any other light. The writer continues: "But Lord Sudeley, in accordance with his recent diagnosis in the House of Lords, might regard this as the mere 'opinion' of an obstinate man. I will therefore resort again to 'objective' evidence. On September 22, 1874, Sir William Thomson paid a visit to Howth Bailey, and in the journal of the 'lighthouse,' after referring to 'the beautiful triform,' and to 'the admirable practical qualities of Mr.

Wigham's apparatus,' by which certain effect observed from the Salt Hill Hotel had been produced, Sir William Thomson thus speaks of the single lights: 'The value of gas for lighthouse illumination is admirably illustrated in this establishtment, which, in its present character as a fixed light, is certainly not surpassed by any other fixed light in the world, so far as ecomony and ordinary efficiency are concerned, while it has the great advantage, not possessed by any lighthouse illuminated by oil, that within a minute of time its power can be increassd to upward of four-fold, in case of fog coming on so as to render the higher power necessary or desirable. It is also satisfactory to find that by a very simple mechanism this lighthouse may be converted into an eclipsing light, so as, without at all impairing any of its present excellent qualities, to distinguish it perfectly at any distance, up to the greatest at which it can be seen, from any other light, fixed or variable.' I now invite attention to the effects referred to as witnessed from the Salt Hill Hotel. They are these: First—The great fog power of the 108-jet burner showed an immense superiority of the light over the ordinary light of the lighthouse. The quick transition from the ordinary light to the high power was very remarkable, and seemed most satisfactory. Next day I was very much pleased to see at the lighthouse itself the simple and thoroughly trustworthy apparatus by which this transition was made. Second—The triform light exhibited from the lower position in the neighborhood of the chief tower was strikingly superior even to the great fog power of its 108 burners exhibited in the chief tower, so much so that a heavy thunder-storm which happily chanced to pass during our experiments between the Salt Hill Hotel and the lighthouse completely eclipsed the light of the chief tower, while the triform still shone conspicuously through it. Such evidence, I submit, liberates the question from every subjective error of mine. The Board of Trade need no committee on illuminants, with an expenditure of £4.000, to assure them of the excellence of the gas system. That evidence will be at hand; and here let me add to the testimony of Sir William Tomson that of two gentlemen of undoubted ability connected with the Board of Trade itself. In 1878, Mr. Gray, Secretary of the Marine Department, testifies as follows: 'We made a special visit, and the night was very favorable for a test—that is to say, it was sufficiently thick to render the ordinary light invisible from the place where we were stationed; and I can from my own observation, which was carefully and patiently made, assert with entire confidence that, as one light after another was added, the illuminating power was materially and markedly and visibly increased, and that the ordinary light still being invisible, the quadriform not only illuminated the fog, but actually became visible.' To the same effect is the testimony of Mr. Hamilton, now Under Secretary for Ireland. 'I distinctly remember how the power of the light to penetrate fog was increased as the burners in each tier were lighted. I remember, also, that while the fog at times obscured the ordinary light, the quadriform was distinctly visible.' I wonder whether landsmen sufficiently realize the fact that the difference between a light 'conspicuously visible' and a light 'completely eclipsed' may mean the difference between life and death to our sailors."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Toronto (Can.) Furnishes a Victim.—A Niagara hotel-keeper named McMillen, while on a visit to Toronto (Can.) blew out the gas in his room at the Beaver hotel, Jarvis street, on retiring to bed on the night of July 16. Not having made his appearance at the breakfast table next morning, a servant was sent to awaken him; the messenger not being able to elicit any response to the summons, forced open the door, and the unfortunate man was found dead in his bed. Water gas is manufactured and sold in Toronto.

The Chicago Gas Light and Coke Company to Sell Gas at $1 per Thousand.—Mr. E. T. Watkins, President of the Chicago (Ills.) Gas Light and Coke Company, has caused the following circular to be issued to the patrons of his company. The circular bears the date of August 1.

"The Chicago Gas Light and Coke Company has been actively engaged for several months in improving and extending its works, and increasing the capacity of its mains throughout the North and South Divisions, in order to reduce the cost of manufacture, improve the quality and insure an ample supply of gas to all of its customers at the lowest price.

"In pursuance of this object the price of gas was reduced on July 1, from $2.25 to $1.75 per 1,000 cubic feet, and you are hereby informed that a still further reduction to $1.25 per 1,000 will take effect from and after November 1, 1883, when the new machinery will be in operation. A discount of 25 cents per 1,000 will be allowed on all bills paid on or before the 12th of each month, making the net price 'only $1 per 1,000 cubic feet.'

"Notice of this reduction is now given in order that consumers may be assured in advance that this company is fully determined to use all proper means to retain and increase their patronage, against any and all competitive attacks.

"It is expected that at this low price the use of gas will not only supersede all other illuminants, but will be extended for heating, cooking and motive power, so as to justify still further reduction in the future."

Notes from Winchester, Va.—Mr. C. E. Hoover, the efficient superintendent of the Winchester (Va.) Gas Light Company, is showing to the citizens of his town what may be accomplished by the use of gas as cooking agent. On Friday evening, July 27, an exhibition was given at the Court House Hall, which was intended to illustrate the advantages of employing gas for domestic purposes; and the exhibition was successful in every particular. A breakfast for five persons (the edibles consisting of broiled beefsteak, biscuits, fried potatoes, tea and coffee) was cooked in eighteen minutes, much to the wonder and delight of the many fair housewives present. A second illustration of what might also be accomplished was given in the cooking of a good substantial dinner in thirty minutes. A No. 7 Sun Dial was the cooker employed; and it is stated the cost of the gas used in the first experiment was but 1½ cents, and that 3½ cents represented the expense for gas used in cooking the dinner.

At the close of the exhibition the representatives of the Winchester Gas Company offered to place any make of gas stove in the houses of consumers, to run all necessary pipe, give a month's supply of gas free, and give the stove away after gas to the value of three times the cost of the stove had been used. This was not intended to be a permanent offer, but was made for the purpose of introducing the stoves to the people. The initiatory terms offered by the Winchester folks are even more liberal than those made by Mr. Butterworth, of Rockford, Ills., and which he described in the Journal of June 16. Liberality and fair dealing will add many a thousand cubic feet to the account of day consumption.

Gas Matters at Delphos (Ohio.)—The Delphos (Ohio) Gas Light Company have made quite a reduction in the price of gas used for cooking or heating purposes. The regular price of gas in this place is $2.00 per 1,000; but from this figure the following discounts are allowed:

A consumption of 500 to 1,000, 10 per cent.; 1,000 to 1,500 feet, 15 per cent; 1,500 to 2,000 feet, 20 per cent.; 2,000 feet, and over, 25 per cent.

Secretary J. F. McShane writes us that "they want the price of gas to come as near as possible to cost of the fuel used for domestic purposes in the locality—which is generally wood.

"We are bound to compete with everything here, and consumers will always pay a little more for gas. Our works have been in operation about one and a-half years. We send out annually about 5,000,000 feet. We sell our tar at $2.00 per barrel, and coke at 10 cents per bushel. Our coal costs us, delivered in coal-shed, $4.05 per ton. We are adding new consumers right along, and keeping those we have. We are doing very well, with good prospects of doing better. Consumers like cheap gas, and burn more of it when it is cheap."

After the Poles.—John McManus, a merchant on Third avenue, New York City, caused an application to be made before Judge Haight, in Supreme Court Chambers, for a writ of mandamus against the Commissioner of Public Works directing him to cause the removal of a pole erected in front of his (McManus') premises by the United States Illuminating Company. It was claimed on the part of McManus that the authority granted to the Company by the Board of Aldermen was only for the running of wires under the street; that the act was in violation of the Constitution of the State, in that it was taking private property without compensation, and that it interferes with the right of an abutting owner to free ingress and egress in relation to his property. In oposition it was contended that the act was not unconstitutional; that plaintiff having been compensated for his property when the street was dedicated for public use; that as a private owner he had no right to the remedy sought to be enforced, and, therefore the writ should be denied. Decision reserved.

Bridges to be Lighted by Electricity.—At a late meeting of the Park Commission (New York City) Mr. Van Winkle, the engineer to the Board, stated that either gas or electric lamps were needed for the Madison avenue bridge over Harlem River. On motion of Mr. Wales it was decided to have the approaches lighted by gas, and to have electric lights on the bridge proper, provided the engine which was used for operating the draw could furnish the generating power. We are very much afraid that this scheme will not work very well. The Park Commission had better have decided to light both the bridge and the approaches with gas. The treasurer of the board was requested to ascertain the price of a dynamo-machine to light the Third avenue bridge.

The Brush Patents Given Precedence.—At Washington (D. C.) on Thursday, August 2, the patent interference case of N. S. Keith, of the American Electric Storage Company, of New York, agent Charles F. Brush of the Brush Electric Company of Cleveland, Ohio, was decided, priority of invention being awarded to Brush. The declaration in the case contained three counts, each supposed to represent a distinct invention claimed by both

parties, as follows: First, a secondary battery having a plate of cast lead supporting the active coating; second, a secondary battery element consisting primarily of cast lead; third, a method or process of making a secondary battery element consisting in casting a suitable body, frame, or other support of lead, and placing thereon an active or absorbing coating or substance.

ALBANY (N. Y.) STREET LIGHTING.—The Albany *Times* does not appear to think that electricity for street lighting is such a good thing after all. It sums up the situation pretty clearly, when it gives voice to the following:

"It costs the city at the very lowest calculation $78,263 a year for lighting the streets with electricity, while gas, at the very highest, under the present contract, would cost $40,845. That contract expires in a short time, and we have the best authority for saying that it can be renewed to-day for $25 a lamp. In other words, the city can be lighted the same number of hours as before, with 1,167 gas lamps (the old number) for $29,175 per year, or a trifle over one-third what we pay now for electricity; and if the hours are reduced to the same number for which the electric light company furnish light, it will be done for a great deal less. Champagne is better than cider, but it costs more. Electricity is more brilliant than gas, but is it enough better to equal the difference each year between $78,263.50 and $29,175? Can the tax-payers afford so costly a luxury?

THE CHAUTAUQUA HEAT AND LIGHT COMPANY.—The Chautauqua Heat and Light Company, of Jamestown, N. Y., which was incorporated some time ago, has obtained permission from the town authorities to commence operations. The company proposes to expend $500,000 in building a pipe line from the Clarendon oil region in Pennsylvania (25 miles from Jamestown) for the purpose of conducting natural gas to the latter place. The well from which the supply is to be taken has been emitting vast quantities of gas for the past three years, with no visible sign of the supply diminishing. The new corporation expects to furnish gas for fuel to all the factories, stores and houses in the town. Frederick P. Hayes, of Warren, is President, and F. Allen Brown, of Jamestown, is Secretary of the company. Jamestowners are firm in the belief that the new enterprise will be a great success. It is expected that the pipe line will be completed and in operation within three months.

PERSONAL.—Mr. W. H. Miller has resigned the position of Superintendent and Engineer of the Columbus (Ohio) Gas Light Company; and Mr. E. McMillin has been appointed to succeed him.

Mr. G. A. Hyde, Jr., has left Sidney, Ohio, having accepted the position of engineer to the East Saginaw (Mich.) Gas Light Company.

THE SYSTEM OF GAS-LIGHTED BUOYS GROWING IN FAVOR.—An analysis of the report of the Board of Lighthouse Service, in the United States, for the past year shows that the cost of the service to the Government, was $2,084,000, exclusive of nearly $300,000 expended on new structures. While the number of lighthouses is 725, the number of beacon lights on Western rivers is about 900, and experiments made have encouraged the expectation that gas lighted beacons can be made to serve the purpose of costly permanent lighthouses, in many localities. Lightships, on the other hand, are declining in favor, and there are but thirty left in the service. The number of buoys at present in use is about 3,400, and the practice of lighting them is increasing greatly. The service, as a whole, compares favorably with that of other countries, but many improvements are needed, especially in the districts of the Atlantic Coast.

PHILADELPHIA GAS TRUST RECEIPTS.—From the report of the controller of the Philadelphia (Pa.) Trust, for the first six months of the fiscal year 1883, we learn that the receipts amounted to $2,157,902.53, as against $2,110,944.27 for the last six months of the previous year, showing an increase of $46,958.26.

A PROPOSED MURDOCH MEMORIAL.—A proposition is being agitated in England at the present time which has for its object the recognition of the services of Murdoch in giving to the world the great modern illuminator—coal gas. It appears that the orginator of the movement, Mr. M. Macfie, had his attention directed to such an idea, from the fact that Murdoch's house at Handsworth, Birmingham, and the place of his residence at the time when he (Murdoch) was wrestling with the details of the problem which has since been successfully worked out in all parts of the civilized world, is in the way of that most restless of all mortals—the speculative builder who wishes to demolish the ancient structure, in order that a dozen modern structures may occupy its place. Mr. Macfie has even gone so far as to suggest that the home of the inventor might be purchased and occupied as the permanent headquarters of the Gas Institute. The London *Journal*, in commenting on this proposition, speaks as follows:

"While recognizing Mr. Macfie's efforts in seeking to secure national recognition for Murdoch and his work, it still behooves us to weigh his suggestions, with a view to ascertain whether they are in all respects suitable. It is always a very difficult task to select a memorial of a departed worthy, especially if his claims to be remembered are special in their nature and limited in their range. In a sense, of course, every benefactor of his fellows is a benefactor of all. Still, it is not to be expected that every one who benefits by the work of an inventor or discoverer, should know how much he is indebted to the particular individual, who may have died a century before. It is the special privilege of those who may be called the pupils, disciples, or followers of public benefactors, to show to their fellow-citizens how the memory of the master should be kept green. In France they are trying to collect funds for a statue to Lebon; but without much encouragement. On the whole, statues to eminent men are of small use for their ostensible purpose, and frequently only serve the same end as making a memorandum in a note-book—to enable one to dismiss the subject from his mind. We do not wish to discourage Mr. Macfie; but it is necessary to point out that gas companies cannot respond to his invitation to contribute funds for the purpose he has in view. Neither can the Gas Institute, as such, whatever the members may be inclined to do in their individual capacity. It is, unfortunately, out of the question that the Institute should fix its headquarters at Handsworth, as it would be in the case of Murdoch's other homes at Redruth and Old Cumnock. This consideration suggests the reflection that, after all, objective memorials are of more good in local sense than in any other. It has a certain effect upon the inhabitants of a place to be constantly reminded that a memorable man lived among their forefathers. In this sense the proposed acquisition, for public purposes, of the house at Handsworth may be regarded as a Birmingham question. Not that this fact should deter residents in any other locality from lending a hand in the work; but as the successful result of such an effort would be of distinctly local import, it is for the men of Birmingham to show that they are specially desirous to adopt this particular method of honoring the memory of their famous townsman. This is the point, therefore, to which Mr. Macfie must next direct his attention, if the movement which he has initiated with such credit is to be maintained to a successful issue."

GAS WORKS AT MANKATO, MINN.—The Mankato Gas Light Company, of Mankato, Minn., have pushed the work of construction rapidly. The new establishment will be in complete working order, and ready to supply gas early in the Fall.

PROTECTING IRON FROM RUST.—*Les Mondes* recommends the following: "Treat the casting with dilute hydrochloric acid, which dissolves a little of the metal and leaves on the surface a firmly adherent skin of graphite. The article is then washed in a receiver with hot and cold water, or steamed, so as to completely remove the chloride of iron that has been formed upon it. The piece is then allowed to dry in the empty receiver, and a solution of caoutchouc, gutta-percha, or gum resin, dissolved in essence of petroleum (benzine) is injected. The solvent after evaporating, leaves a hard and solid enamel on the surface of the metal. By another plan, the chloride of iron is not removed, and the piece is immersed in a bath of silicate and borate of soda. A hard and brilliant film of silicoborate of iron is thus formed, which effectually protects it. The chlorine combines with the sodium to form chloride of sodium, which remains in the pickle."

GOOD WORK DONE BY A "WESTINGHOUSE" ENGINE.—*Iron Age* says that last season the Continental Iron Works people, while pumping out an excavation for a gasholder, situated in a salt marsh, broke down the old engine which was driving the centrifugal pump. About 30-horse power was required for the work, and the only available engine was a 7 × 7 Westinghouse, which is nominally only 18-horse power. The governor was taken off and the valves got the steam direct. The engine was speeded to run at 700 revolutions per minute, and the pulleys arranged accordingly in order to get the required speed out of it. The engine was in rather a hard position for any machine, being in the excavation, on a scantling scaffolding, where it was exposed to the drip of the salt water which was being pumped. It was started on the 28th of May, and ran continuously till the middle of the next October, nights, days and Sundays, excepting three stops of 15 minutes each. During all this time it was at work developing 30-horse power and making 700 revolutions per minute.

MACHINERY AND FITTINGS FOR THE RICHMOND (VA.) GAS WORKS.—At a meeting of the Committee on Light, of the Richmond (Va.) Council, held on Thursday, August 9, a contract was awarded to Talbot & Sons, of Richmond, for the construction of two purifiers 14 × 22 feet, 30 inches deep, with 16-inch connecting pipes, valves, etc., put up ready for use; also, one horizontal 15-horse power return tubular boiler, including brickwork for engine foundation, boiler setting and smokestack, engine and boiler to be set up complete with all connections ready for work; a contract was also awarded to Smith & Sayre Manufacturing Company, of New York city, for one of Mackenzie's exhausters of 1,000,000 cubic feet capacity.

Taylor and Anderson, who have the contract for remodeling the retort house, are progressing satisfactorily with the work.

Mr. J. M. Higgins, Chairman of the Committee on Light, writes us that he wishes, through the columns of our Journal, to return his grateful thanks to the many friends throughout the country who furnished him with valuable information in his last contest with the water gas prowlers; and we would here add that the gas men of the country must acknowledge the sturdiness and value of the efforts made by Mr. Higgins and his confreres in the course taken by them in the matter of the Richmond Gas Works, and also to state that, as far as thanks are concerned, it is Mr. H. who should receive the thanks of all those who are interested in sustaining the manufacture of a gas which is the least deleterious to health and life.

Price of Gas Reduced in Denver, Col.—On August 7, the Denver (Col.) Gas Light Company made the announcement that the prices to be charged for gas, from date of August 1, would be as follows: $1.80, $1.90, and $2.00 per 1,000 cubic feet net, according to amount consumed. The rates which prevailed previous to the new arrangement were $2.00, $2.25, and $2.50 per thousand. Secretary Fay reports that business is brisk, and expects to so increase his sendout, on account of the reduction just made, as to enable him in the near future to still further lower the price to consumers. The Denver *Tribune*, in noticing the new schedule of rates, actually speaks a good word for the gas company. Such a course is so startling for a newspaper to take that we feel called upon to place it upon record. This is what was said:

"The gas company has made a decided reduction in the price of gas. We are glad to mention this. A reduction of any sort where the public is concerned is a good thing, and is worthy of a good word."

Still Cheaper Gas for Wheeling, West Va.—At a meeting of the Committee on Ordinances, of Wheeling, West Va., held August 3, the following communication was received from Mr. Edward Hazlett, Secretary of the Board of Gas Works Trustees:

"To the Committee on Ordinances:

"Gentlemen—The Trustees of the gas works respectfully ask your honorable body to amend the existing section No. 10 of the city ordinances, in relation to the gas works, by fixing the price of gas at $1 per 1,000 cubic feet, subject to a discount of 10 per cent. if the bill be paid at the gas office on or before the 10th day of the month in which it becomes due. An examination of the books of the gas office will show that by economical management the price of gas can be reduced to the above named figure and insure a safe margin each year for improvements. This, however, based upon the present consumption, is the minimum price at which gas can be supplied to consumers, notwithstanding assertions to the contrary. The experience of all gas companies has been that a reduction in the price of gas has been speedily compensated by a corresponding increase in the consumption; with this in view, and our improved facilities for the manufacture, and on the part of sound business policy, we ask you to make the desired amendment."

The Committee instructed the Solicitor to prepare the proper ordinance and present it before them at its next meeting, at which session there is but little doubt the ordinance will be enacted and made binding. We shall then have one place, at least, in the United States where gas will cost the consumer less than $1 per 1,000 cubic feet; and where such price is not made merely for the purposes of opposition warfare. It will be kept in mind that the Wheeling Gas Works is owned and controlled by the town authorities; and while we do not believe that town authorities should engage in any manufacturing business, we still must give the officials in charge of the Wheeling undertaking the credit of being public-spirited, progressive and liberal-minded men. When it was discovered that improvements and extensions were needed to the existing plant, in order that the gas supply might be made as thorough as possible to the consumers of the place, the requisite authority was given, and the needed amount appropriated, without any unnecessary haggling, bickering, or delay. That the course taken was the proper one at no time admitted of doubt; but in order that the "blind may even see" we may point to the price for gas which is now likely to prevail in this particular locality.

The Wheeling corporation consumer's list numbers 2,500; last year the sendout amounted to 87,000,000 cubic feet; and of this quantity the city burned, in public lamps and city buildings, one-sixth of the whole, and for which no charge was made. Another item which is well to take due cognizance of is the statement that the leakage and unaccounted-for gas account reaches but 9 per cent.

And Still the List Grows.—Walter P. Sumwalt, 25 years of age, a son of Mr. Thomas S. Sumwalt, of Waverly, Md., was suffocated on the night of Aug. 8 by inhaling water gas in his room, situated over the bakery shop of White & Myers, at the corner of Lanvale and Stricker streets, Baltimore, Md. Young Sumwalt had been employed for about a month in driving one of the bread-delivery wagons of the above-named firm, and is reported to have been a young man of very regular habits. He retired between 9 and 10 o'clock on the night in question, and was to have been called at 3:30 A.M. The servant sent to wake him at the appointed time found young Sumwalt in bed, in an unconscious condition; the room was full of gas, which had escaped, and was then escaping, from a bracket burner situated right close to the bed. The burner cock was half turned open, and it is believed that Sumwalt must have turned it too far around when putting out the gas, or else that he accidentally struck it in moving about during the night to get some medicine, he being slightly indisposed. Dr. W. K. Warner was called, but by the time he arrived the sufferer was dead. The coroner, Dr. A. Tinsley, deemed no inquest necessary, as the death was evidently accidental.

And Yet Another.—Mr. Henry Morris, a well-known clothing manufacturer of Baltimore, Md., and Washington, D. C., was found dead in his bedroom at 1:30 o'clock on the afternoon of Saturday, August 11. Mrs. Morris, the wife of deceased, stated that for three nights her husband had been unable to sleep on account of an accute attack of toothache. Early on the morning of the date in question, she persuaded him to try the effects of an anodyne, in the hope that he might thus obtain the needed rest. Mr. Morris complied with her request, and retired to bed. About 5 o'clock A. M., Mrs. Morris, who was sitting up in an adjacent room nursing a sick child, heard Mr. Morris walking about for a short while; after which all was quiet. At half-past one a servant was sent to awaken him; the girl found the door locked, and receiving no response to her calls, became alarmed and called assistance. The door was forced open, and a volume of gas poured out, almost suffocating those who entered the room. Mr. Morris was found lying on his back, dead, the body being cold, death having evidently taken place some time before. The key to the gas burner was found turned on full. The supposition is that Mr. Morris lit the gas for some purpose or another, and, in turning off the cock, probably turned it (being loose) all the way around. Coroner Tinsley was notified.

This Time not Fatal.—Charles Vaughn, aged 21 years, living at No. 27 Sterrett street, Baltimore, Md., was discovered, at a late hour on the night of Saturday, August 11, lying in his room in a unconscious state, due to the fact of having inhaled gas escaping from a burner that had not been properly turned off. Dr. R. C. Smith was summoned, who succeeded, after considerable effort, in restoring the sufferer to consciousness.

Electricity on East River Ferryboats.—The Union Ferry Company, the title of a corporation operating a system of ferryboats from five different points on the East River, between the cities of Brooklyn and New York, has been experimenting with the view of replacing the present gas system of illumination in the boats with that of electricity. The ferryboat Fulton has accordingly been equipped with Weston dynamos, which furnish the current to 64 Maxim lights. The boats are divided into four cabins—two forward, and two aft, with a central space between, which is devoted to the transportation of horses, drays, trucks, etc. Each of the four cabins contains 16 Maxim lamps, suspended from the ceiling in much the same style as the ordinary gas chandelier; there are eight lamps to each chandelier, and the flood of illumination is very great indeed. The gas brackets which were formerly in use on this same boat numbered but four to the cabin, and were placed on one side of the vessel, being continually exposed to a severe draught. Had the same number of 6-feet gas burners been arranged in a manner similar to that employed in placing the incandescent lights, there is no doubt but that the lighting would be accomplished in a far more satisfactory manner, and at a considerably less cost.

The Market for Gas Securities.

Some little business in city gas securities has manifested itself during the past fortnight; but, in the main, dullness may still be recorded as the prevailing feature. What transactions did actually occur were at firm figures, if we except the marked case of the Northern Gas Light Company, city, which company passed its semi-annual dividend, due to be declared on Aug. 1st. This furnishes a plausible explanation of why so much of this stock was offered for sale during the last days of the month of July. The reason given for the passing of the dividend is that the company wishes to expend a considerable sum of money in the extension of its mains. If this is the direction in which the expenditure is to be made, the stockholders need not feel uneasy—extending mains means new business, and new business should mean more profit, even if the profit should be in the future. The Central Gas Co., city, paid its semi-annual dividend of 3 per cent. on August 1st. All classes of city gas stocks show somewhat higher figures. We quote New York at 125 to 130; Municipal, 182 to 185; and the previous quotations will about express the present state of values for the balance of the city list. In Brooklyn, matters are still mixed, although we note a tendency to higher prices for both old Brooklyn and Fulton Municipal, showing that there is probably some truth in the rumors that the "agitation" in gas circles in the City of Churches is about to be "settled."

Out-of-town shares are firmer; we quote Consolidated gas, Baltimore, Md., at 44½ to 44¾, which is quite an advance. San Francisco securities are also higher.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Day Consumption.

NEW HAVEN, July 31, 1883.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I cannot find any statement of the amount of gas used by day as compared with that used in the night. It does not appear to have engaged the attention of engineers as a matter of any interest or importance. In this I am convinced they are in error. I find, for example, that a reason assigned by some managers for the lukewarmness, or hostility, to the use of gas for mechanical and domestic purposes in the day is, that more pressure on the mains is demanded to make such use satisfactory than can be afforded by the objectors; because, they say, the leakage increases as the square of pressure. Without now pausing to discuss the accuracy of this statement—as respects the ratio of increase of leakage with pressure—it appears to me to prove too much. If we cannot stand a pressure of 1½" to 2" by day, how is it we can afford it at night? The only sensible answer to such objectors is to say, "*Stop your leaks!*" reduce this loss to a minimum at all times. Evidently the greater the use of gas on a given cost for plant, including distribution, the less the cost of manufacture; *e. g.*, if by encouraging and developing the daylight use of gas for mechanical, manufacturing, and domestic purposes, an increase of say one-half is gained in consumption for 24 hours, it is equivalent to a corresponding increase of productive capacity and distribution counted only on an illumination basis, and that would mean, of course, more plant, more street mains, more meters, more men, etc., etc.

The cry for cheap gas goes up all the time, and will continue to be raised. The price has fallen to the consumer steadily, for many years, in spite of the outcry that the clamor of consumers falls on deaf ears. We all know how unreasonable this cry often is, and how ignorant are most of those, who make the most noise, of the real difficulties standing in the way of reduced prices for gas. But its use as a mechanical power for driving motors, and as an agent for heat, is daily commanding more attention, and prejudices against its use for these purposes are rapidly giving way before the practical teachings of experience. These uses all tend to cheapen the manufacture of gas, and consequently to a reduction of price. Every factor embraced in this problem is important to be known, and one of these factors is the ratio in every case between the day-time and the night-time consumption of gas.

A single additional observation at the station-meter will supply this datum. A sun-down record supplies all we need; we have the sun-rise record now; the difference between those two is the day-light consumption. I hope this matter may receive the attention which it appears to deserve.

There is very much to say on this general subject which must wait another occasion. But we may ask, "where is the long promised gas engine uniting efficiency with reasonable cost?" Do the Otto patents cover all possible forms of constructions; or are these dogs in the manger which may be removed?

Yours truly, B. SILLIMAN.

Don't Believe in Water Gas.

153 WEST FORTY-SIXTH STREET,
NEW YORK CITY, August 9, 1883.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I have read, with a good deal of interest, the paper by Mr. Pearson, read at the meeting of the American Gas Light Association in 1880, and that by Mr. Burns, read at the late meeting of the Western Gas Association. As the subject is of considerable importance to both producer and consumer, perhaps some further ventilation of the topic may be in order.

It is to be regretted that gentlemen present and read papers on entirely new processes without any further indorsement than that of mere assertion—the whole subject matter of which may be more as to what the writers wish than what they can prove. I am led to this last remark in consequence of Mr. Burns putting forth Mr. Pearson, of Toronto, as one who knew all about it. Going back to Mr. P.'s paper, I could not, and cannot, reconcile this production with the actual facts in Toronto as happening at the time when this paper must have been written, and, indeed, for many months previous to its preparation. Before entering upon Mr. Pearson's part of the subject, I might observe that it seems rather paradoxical for Mr. Burns to figure down to a dot everything relating to the manufacture of water gas at Pullman, Ill., and then refusing to produce the very essence of the inquiry, viz., the price—calling it a "trade secret;" also, having found the Eldorado of all that was delightful, he suddenly vacates, and leaves behind him all the beautiful pictures he had created. He claims no loss by leakage, no trouble from condensation, and sells more gas than he makes. Only one dark spot appears—the two men killed by carbonic oxide. But this fatality, he claims, was due, in part, to bad whiskey—setting up the plea of contributory negligence. How many fatal cases would have been on record (attributable to the bad whiskey plea) had water gas been in use for the last 50 years?

In October, 1880, I find Mr. Pearson, secretary of the Consumers' Gas Light Company of Toronto, read a paper on the "Manufacture of Water Gas in Toronto," before the Chicago Meeting of the American Gas Light Association. He therein claims a great success for the undertaking, and elaborates his paper with numerous tabulated statements—leaving nothing to be added, if we except the cost price per 1,000 cubic feet. Now, having been in Toronto several months before and after the above mentioned date, I must, with all due respect to Mr. Pearson, dispute some of his claims, and state that no one knows better than himself that, so far as the public was concerned, the water gas system was a positive failure; and had there been any other gas company on the ground, Mr. P.'s company would not have retained an independent consumer at the very date on which his paper was read. Water gas and the Toronto company were anathematized in general and Mr. Pearson in particular. The press denounced it; the public denounced it; the mayor and aldermen did the same. The dissatisfaction was such that a committee was ordered by the common council to take expert testimony on all the facts; and, as a consequence, in December of that year (1880) the Consumers' Company had to go back to the making of coal gas. The great complaint on the part of the public was the trouble occasioned by the incessant choking up of the meters, services, and fittings with tar slush, which, I notice, Mr. Pearson called naphthaline. I have seen nearly a gallon of this tar slush taken out of a meter twice in one month. Then, again, the gas supply was so variable that many consumers were obliged to use oil lamps; and, to cap the climax, people were alarmed in consequence of the many deaths that occurred.

An answer made by Mr. P., relative to the deaths, was suggestive of the one-man power, viz., that "gas was made to burn and not to inhale." During a controversy which I had with him in 1878, he quoted his coal gas as costing his company 47 cents per 1,000 feet. In his paper he claims 15 cents more profit from water gas; so we may infer that his water gas costs him but 32 cents. It is somewhat amazing when he speaks of the engineers employed by the Consumers' Company, since, in point of fact, this same concern has not employed an engineer for over ten years—Mr. Pearson being autocrat of all the Torontonians.

A word may be said here in reference to the apparent waste of capital. The Toronto company is called, by its charter, the Consumers' Company, and has a defined capital on which it is allowed to pay 10 per cent. When the company derives more than enough profit from the sale of gas, at the figure stated in its charter, such surplus is to be given to the consumers in the shape of a reduced price of gas. This company, having a monopoly, and a large consumption at high rates, paid the 10 per cent., built fine offices, worth $20,000, and had plant ample for all requirements. For reasons best known to themselves, they wished to place in idleness the $300,000 of capital invested in the coal gas plant; and so applied, in 1881, to the Ontario Parliament for powers to increase the capital another $300,000. The object of this application was to raise money for the purchase of the patent rights, and to erect the necessary plant, for manufacturing water gas. The Toronto Parliament very properly refused to consent to this.

Mr. Burns admits the danger of using water gas, when he suggests the necessity of educating consumers up to the requirements of its use; but the public have used coal gas for over half a century, and with only very ordinary care have had nothing to complain of. This same public will consequently fail to appreciate the new order of things. There can be no doubt that thousands of people have, either through ignorance, inadvertence, or carelessness, blown out coal gas flames, and fatal results have not followed, because the gas instantly rises, and will escape through the smallest opening. On the other hand, water gas, directly it leaves the burner unconsumed, descends. I made a practical experiment on this fact (in Toronto, during the contention), by placing a pipe-light jet on a rising pipe, at direct right angles. On turning on the gas, I caught the stream with a match, on a curved line six inches below the point of exit. It is quite clear that, with its great density and the presence of such excessive quantities of carbonic oxide, water gas must of necessity be dangerous as an agent for domestic use. There would appear to be no need for the introduction of the water gas system, when there is such an abundance of gas coal to be obtained at a moderate cost, without taking into consideration the valuable residuals which may be so profitably disposed of. I could give you numerous instances of the immunity from danger in inhaling coal gas—one of which I will mention: Twenty years ago I had a man in my employ in a gas works of which I had charge; this man took two cart loads of foul lime out of a purifier; he had omitted to close a 6-inch inlet valve leading into the box, and paid the penalty to be expected under such circumstances. It was over an hour before his perilous position was discovered. I dragged him out, gave him a good dose of brandy, and in two hours he was able to go home. The next morning he had quite recovered.

Yours truly,

JOHN KEELING, C.E.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks (with W. B. Scott & co.,)

34 Pine Street, New York City.

August 16, 1883.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Central	$466,000	50	85	90
Harlem	1,800,000	50	100	—
" Bonds	170,000		—	—
Manhattan	4,000,000	50	230	235
Metropolitan	2,500,000	100	186	192
" Bonds	658,000	—	105	110
Mutual	3,500,000	100	116	120
" Bonds	1,500,000	1000	103	105
Municipal	3,000,000	100	182	185
" Bonds	750,000		102	104
New York	4,000,000	100	125	130
Northern	125,000	50	—	95
" Scrip	108,000			
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	115
Citizens	1,200,000	20	69	73
" S. F. Bonds	320,000	1000	105	107
Fulton Municipal	1,500,000	100	75	80
Peoples	1,000,000	10	45	50
" Bonds	290,000	—	104	107
" "	250,000	—	88	90
Metropolitan	1,000,000	100	80	85
Nassau	1,000,000	25	50	60
" Ctfs	700,000	1000	90	93
Williamsburgh	1,000,000	50	73	—
" Bonds	1,000,000	—	100	101
Richmond Co., S. I.	300,000	50	—	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	72	75
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	80	85
" " Bonds.	124,000	—	105	10
Chicago Gas Co., Ills			150	155
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			44½	44¾
" Bonds			105	106
Central, S. F., Cal			45	—
Capital, Sacramento, Cal			—	56½
Hartford, Conn	750,000	25	116	12
Jersey City	750,000	20	155	165
Laclede, St. Louis, Mo.	1,600,000	100	100	105
Montreal, Canada	2,000,000	100	186	187
New Haven, Conn		25	152	160
Oakland, Cal			—	29¾
Peoples, Jersey City		—	72	75
" " Bonds			—	—
Paterson, N. J		25	96	99
Rochester, N. Y		50	70	80
Washington, D. C	2,000,000	20	175	—
Wilmington, Del		50	174	—
Yonkers		50	33	35
St. Louis, Missouri	600,000	50	250	254
San Francisco Gas Co. San Francisco, Cal.			59¼	60

Advertisers Index.

	Page
GAS ENGINEERS.	
E. McMillin & Co., Ironton, Ohio	86
Jos. R. Thomas, New York City	86
GAS WORKS APPARATUS AND CONSTRUCTION.	
James R. Floyd, New York City	91
T. F. Rowland, Greenpoint, L. I	91
Delly & Fowler, Phila., Pa	91
Kerr Murray Mfg. Co., Fort Wayne, Ind	91
Stacey Mfg. Co., Cincinnati, Ohio	91
Bartlett, Hayward & Co., Baltimore, Md	91
Morris, Tasker & Co., Limited, Phila., Pa	91
Davis & Farnum Mfg. Co., Waltham, Mass	62
GAS AND WATER PIPES.	
A. H. McNeal, Burlington, N. J	90
Gloucester Iron Works, Phila., Pa	90
James Marshall & Co., Pittsburgh, Pa	90
R. D. Wood & Co., Phila., Pa	90
Warren Foundry and Machine Co., Phillipsburgh, N. J	90
Mellert Foundry and Machine Co., Reading, Pa	90
SCRUBBERS AND CONDENSERS.	
G. Shepard Page, New York City	89
RETORTS AND FIRE BRICK.	
J. H. Gautier & Co., Jersey City, N. J	88
B. Kreischer & Sons, New York City	88
Adam Weber, New York City	88
Laclede Fire Brick Works, St. Louis, Mo	88
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y.	88
Borgner & O'Brien, Phila., Pa	88
Gardner Brothers, Pittsburgh, Pa	88
Henry Maurer, New York City	88
Evens & Howard, St. Louis, Mo	88
Chicago Retort and Fire Brick Works, Chicago, Ills	88
Taylor and Anderson, Cincinnati, Ohio	88
DIETERICH'S REGENERATOR FURNACE.	
Charles F. Dieterich, Baltimore, Md	88
GAS STOVES.	
American Meter Co., New York and Philadelphia	87
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa.	72
VALVES.	
Ludlow Valve Manufacturing Co., Troy, N. Y.	90
GAS METERS.	
Harris, Griffin & Co., Phila., Pa	94
American Meter Co., New York and Philadelphia	95
The Goodwin Gas Stove and Meter Co., Phila. Pa.	95
Helme & McIlhenny, Phila., Pa	95
Maryland Meter and Mfg. Co., Baltimore, Md	94
D. McDonald & Co., Albany, N. Y	95
EXHAUSTERS.	
P. H. & F. M. Roots, Connersville, Ind	86
Smith & Sayre Manufacturing Co., New York City	92
PROCESSES.	
Strong Gas and Fuel Co., Yonkers, N. Y	86
Thomas B. Fogarty, New York City	94
GAS COALS.	
Penn Gas Coal Co., Phila., Pa	93
Perkins & Co., New York City	92
Cannelton Coal Co., New York and Philadelphia	93
Newburgh Orrel Coal Co., Baltimore Md	93
Despard Coa Co., Baltimore, Md	93
Fort Pit Gas Coal, Pittsburgh, Pa	93
Chesapeake and Ohio R.R Coal Agency, N. Y. City	93
Westmoreland Coal Company, Phila., Pa	93
Breckenridge Cannel (Perkins & Co.), N. Y. City	92
GAS ENGINES.	
Shleicher, Schumm & Co., Phila., Pa	90
STREET LAMPS.	
J. G. Miner, Morrisania, New York City	86
PURIFIER SCREENS.	
John Cabot, Lawrence, Mass	85
BURNERS.	
G. Gefrorer, Phila., Pa	90
G. Shepard Page, New York City	92
PURIFYING MATERIAL.	
Connelly & Co., New York City	95
STEAM BLOWER FOR BURNING BREESE.	
H. E. Parson, New York City	86
GAS FIXTURES.	
Mitchell, Vance & Co., New York City	91
CEMENT.	
F. O. Norton, New York City	95
TAR BURNER AND TAR VALVE.	
S. H. Douglas, Ann Arbor, Mich	92
STEAM ENGINES.	
Westinghouse Machine Co., Pittsburgh, Pa	86
FOR SALE.	
Gardner Brothers, Lockport, Pa	85

FOR SALE.

Gardner Bros. Gas Retort and Fire Brick Works.

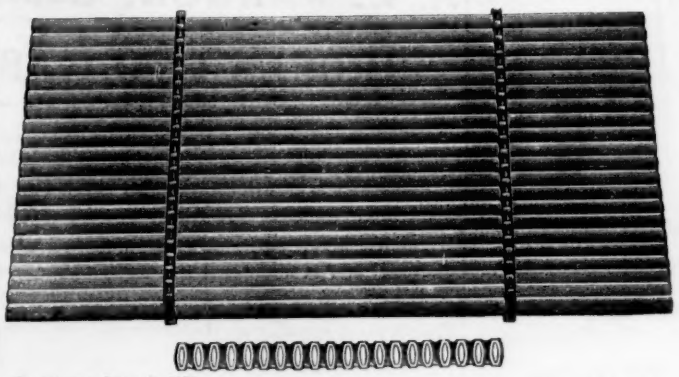
Established in 1864. Situated at Lockport Station, on the P. R. R., 60 miles from Pittsburgh, Pa. The Works consist of complete plant for manufacturing Clay Gas Retorts. Settings, Blocks, Tiles, and Fire Brick. Capacity, about 100 retorts, with necessary settings, and 100,000 fire brick per month. Clay and coal mined by ourselves within short distance of Works and hauled in wagons. Over three acres of land, with all necessary buildings, a number of tenements and town lots. The P. R. R. has side track alongside our kilns. Good trade established. Our good will and influence to go with sale. Statement of business done will be shown to responsible parties desiring to purchase. Any further information desired will be cheerfully given by Gardner Bros., Lockport, Pa.

ALSO,

Gardner Bros. "Standard Savage" Fire Brick Works.

Established in 1873. Situated at Ellerslie Station, Md., on Balt. & O. R. R.; also on Bedford Branch of P. R. R. Has convenient shipping arrangements on both roads. Works consist of two independent plants of machinery, so constructed and arranged that they can be run separately or together. One of the buildings entirely new, erected last year. Capacity of Works, over 14,000 bricks per day. Mount Savage Clay in abundance, mined on royalty, and delivered direct into Works by gravity. Inclined plane and tramroad, large portion of which was laid with new T-rail last year. New artesian well, capacity over 35 barrels per hour; also mountain stream delivering water by gravity into tanks at Works. Seven acres of land, with 9 good tenements. Everything in first-class order for manufacturing and shipping brick direct from kilns into cars. Good and growing trade established. Brick unquestionably as good as the best made of Mount Savage Clay. Statements of business done will be shown to responsible parties desirous of purchasing. Our good will and influence to go with sale. Any further information desired will be cheerfully given by Gardner Bros., Lockport, Pa.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



Patented July 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

LAWRENCE, MASS.

In Use at the Following Gas Works:

Lawrence, Mass.	Cambridge, Mass.	Manchester, N. H	Washington, D. C.	Knoxville, Tenn.
Lowell, "	Haverhill, "	Nashua, N. H.	Staunton, Va.	Richmond, Ind.
Roxbury, "	Providence, R. I.	St. John, N. B.	Charleston, S. C.	Champaign, Ill.
Springfield, "	Newport, R. I.	Fulton Munic., Brooklyn.	Selma, Ala.	Detroit, Mich.
Taunton, "	Pawtucket, R. I.	Municipal, N. Y. City.	Jacksonville, Fla.	Lansing, Mich.
Salem, "	New Haven, Conn.	Northern, N. Y. City.	Denver, Col.	Reno, Nev.
Gloucester, "	Birmingham, Conn.	Citizens, Rochester, N.Y.	Lawrence, Kan.	Peoples, Cleveland, O.
Waltham, "	Burlington, Vt.	Passaic, N. J.	Sedalia, Mo.	Lancaster, Ohio.
Charlestown "	Portland, Me.	Jersey City, N. J.	Kansas City, Mo.	Cincinnati, Ohio.

Now Making Screens for the Following Works:

Chicago, Ill.	Wilmington, Del.	Boston, Mass.	Fulton Munic., Brooklyn.	Pawtucket, R. I.
Allegheny, Pa.	Lancaster, Ohio.	Malden, Mass.	Citizens, Rochester, N.Y.	Nashua, N. H.
Scranton, Pa.	Cincinnati, Ohio.	Haverhill, Mass.	Oscaloosa, Iowa.	Decatur, Ill.

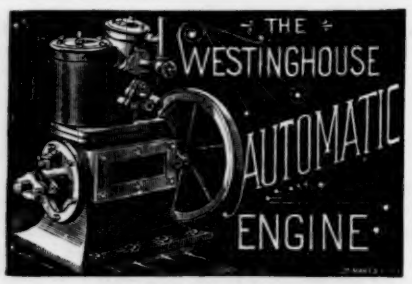
To Gas Co.s and Manufacturing Chemists.

The manufacture of Sulphate of Ammonia at gas works having become exceedingly profitable, especially where a good washer is used (such as the "Standard" washer-scrubber), gas companies will find the following plant very suitable:

Sulphate of Ammonia Plant.—The "Breckon" Process. A continuous method, suitable for either large or small works, giving unexceptional results and satisfaction in working, and is simple both to work and construct. The percentage of ammonia in the spent by this process is brought as low as .065, and using less fuel than any other known method.——The improved "Coffey Still" process. Highly efficient for large or middle sized works. Sulphate white and clean; large results; spent, .070 per ct. of ammonia.——The non-continuous "Plymouth" method. Suitable for small works; highly efficient in working, and cheap to construct; also very simple. **Liquor Ammonia Plant.**—Simply the very best improved continuous methods for making aqua ammonia from gas liquor.

I am prepared to erect plant on reasonable terms, or will supply plans and specifications by which parties can erect their own works. For prices, etc., address

JOHN G. HARVEY,
148 Conselyea St., Brooklyn, E. D.



Automatic Engines, 30 to 300 Horse Power.
Throttling Engines, 4 to 100 Horse Power.

Over 450 Engines and 10,000 Horse Power Now in Use.

Send for Illustrated Circular and Reference List, and

Ask Our Prices!

THE WESTINGHOUSE MACHINE COMPANY,
PITTSBURGH, PA.

Address, if more convenient, our Branch Offices: 94 Liberty St., New York. 14 South Canal St., Chicago. 401 Elm Street, Dallas, Texas.

E. McMillin, Columbus, O. H. B. Wilson, Ironton, O.

McMILLIN & WILSON,
Gas Engineers and Contractors
Will Lease or Purchase Gas Works.
Correspondence solicited.
Address McMillin & Wilson, Columbus, Ohio.

THE GLOBE STREET LAMP.

MINER'S PATENT STREET LAMPS.

Are adapted for use of Streets, Parks, Depots, Ferries, & Private Grounds.

WITH POSTS OR BRACKETS.

Jacob G. Miner,
MORRISANIA, N. Y. CITY.

JOS. R. THOMAS, C.E.,
May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.
ADDRESS THIS OFFICE.

NEWBIGGING'S
Gas Manager's Handbook.
Price, $4.80.
EVERY GAS MAN SHOULD HAVE ONE.
Orders may be sent to this Office.

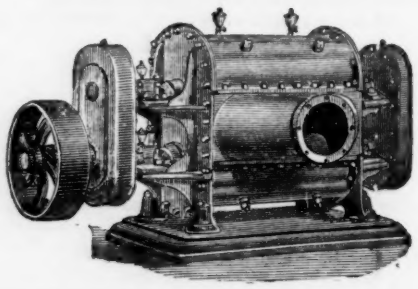
NOW READY AND FOR SALE,
FODELL'S
System of Bookkeeping
FOR GAS COMPANIES.

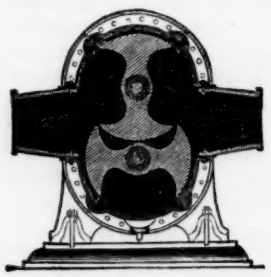
Price $5, which should be sent either in Check, P. O. Ord or Registered Letter.

Blank Books, with printed headings and forms [illegible] system, will be supplied to Gas Companies, by appl[illegible] N. P. Fodell Philadelphia, or

A. M. CALLENDER & CO
Office Gas Light Journal 42 Pine St., N. Y.

P. H. & F. M. Roots'





IMPROVED GAS EXHAUSTER
With Engine on same Bed Plate, or without.
BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, &C., FURNISHED TO ORDER.
P. H. & F. M. ROOTS, } Patentees and Manufacturers, {CONNERSVILLE, IND,
S. S. TOWNSEND, General Agent, 22 Cortland St. and 9 Dey St., N. Y.
JAS. BEGGS & CO., Selling Agents, 9 Dey St., N. Y.
WM. COOKE, Selling Agent, 22 Cortland St., N. Y.
Send for Illustrated Catalogue and Price List.

Parson's Steam Blower,
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.
PARSON'S TAR BURNER,
FOR UTILIZING COAL TAR AS FUEL.
PARSON'S AIR JET TUBE CLEANER,
FOR CLEANING BOILER TUBES.
These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.
H. E. PARSON. Supt., 42 PINE ST., N. Y.

CIRCULAR TO GAS LIGHT COMPANIES.

Branch Office of the Strong Gas Fuel and Light Company,
Corner Broadway and Main Street, Yonkers, July 2, 1881.

The Yonkers Fuel Gas Company is now in successful operation, manufacturing Water Gas by the Strong Process, for Heat, Power, and Light.

It has about two and a half miles of mains already in use through the heart of the city of Yonkers, and is supplying gas for cooking, heating, and various industrial purposes.

The problem of a purely fuel gas is at length practically solved, and is a complete success. That it must speedily go into universal use is apparent to everyone.

Gas Light Companies are cordially invited to visit Yonkers and inspect this new system, which, if electricity *should* eventually drive them out of the field of illumination, will open to them another field still more vast and fruitful, and from which they never can be dispossessed. The Westchester Gas Light Company of the city of Yonkers employes the Lowe Process for making its gas. Here, then, can be seen, side by side in business competition, the Strong and the Lowe against the Motay and the old coal gas methods, and each observer will be enabled to form his own opinion as to their relative power and value. The Strong Gas Fuel and Light Company is the proprietor for the State of New York of the Strong Patents, five in number, and of the Lowe Patents, two in number. All applications for licenses or for information should be addressed, as above, to

R. W. VAN PELT, *President of the Company.*
And also President of the Yonkers Fuel Gas Co., and of the Westchester Gas Light Co.